LOUISIANA COASTAL WETLANDS RESTORATION PLAN

MISSISSIPPI RIVER DELTA BASIN
APPENDIX C

PREPARED BY:

LOUISIANA COASTAL WETLANDS CONSERVATION AND RESTORATION TASK FORCE

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Mississippi River Delta Basin

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INTRODUCTION

STUDY AREA

The Mississippi River Delta Basin is defined as all of the land and shallow estuarine area between the two northernmost passes of the Mississippi River and the Gulf of Mexico. The basin is located in Plaquemines Parish, Louisiana, south of the city of Venice. Baptiste Collette Bayou, on the east side of the river, and Red Pass, on the west side, form the basin's northern boundary. This area is also referred to as the Plaquemines-Balize or "Bird's foot" Delta. The basin encompasses approximately 521,000 acres and is shown in Figure 1. Approximately 129,000 acres of land and water in this basin are in public ownership. This includes approximately 14,000 acres of the rivers channel and passes which are navigable waterways of the United States.

EXISTING PROJECTS

U.S. ARMY CORPS OF ENGINEERS

The Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana, project provides for 40-foot deep-draft navigation channels in Southwest Pass and in the Mississippi River upstream to Baton Rouge, Louisiana, and for a 30-foot channel in South Pass. The channel widths pertinent to the Mississippi River Delta Basin are: Southwest Pass Bar Channel, 600 feet; Southwest Pass, 800 feet; and Mississippi River from the Head of Passes to New Orleans, 1,000 feet. All channel construction under this authority was completed in 1963. The maintenance of the 30-foot channel in South Pass was discontinued after the last maintenance dredging in 1977, and it has shoaled to a depth of approximately 17 feet. Other pertinent features constructed under this authority include the headland dikes between Southwest Pass and South Pass to control the distribution of flows between the two passes and foreshore dikes and jetties along Southwest Pass to help confine flows to reduce maintenance dredging requirements.

The Mississippi River Ship Channel, Louisiana, project authorized the enlargement of the 40-foot channels in the Mississippi River and Southwest Pass to a project depth of 55-feet between Baton Rouge, Louisiana, and the Gulf of Mexico. The deepening of Southwest Pass and the Mississippi River would increase the frequency and duration of saltwater intrusion, and the project provides for the construction of measures to mitigate the effects of this increased saltwater intrusion on municipal users of Mississippi River water. The construction of a 45-foot depth channel in Southwest Pass and in the Mississippi River to Donaldsonville, Louisiana (mile 181 above Head of Passes) was completed in December 1988. Saltwater mitigation procedures are underway, and construction of a 45-foot channel between Donaldsonville and Baton Rouge, Louisiana, is scheduled to begin in the third quarter of 1994. Work is not scheduled for the deepening of the channels in the Mississippi River and Southwest Pass below 45 feet.

The Mississippi River Outlets, Vicinity of Venice, Louisiana, project provides for a 14- by 150-foot navigation channel in Baptiste Collette Bayou on the west side

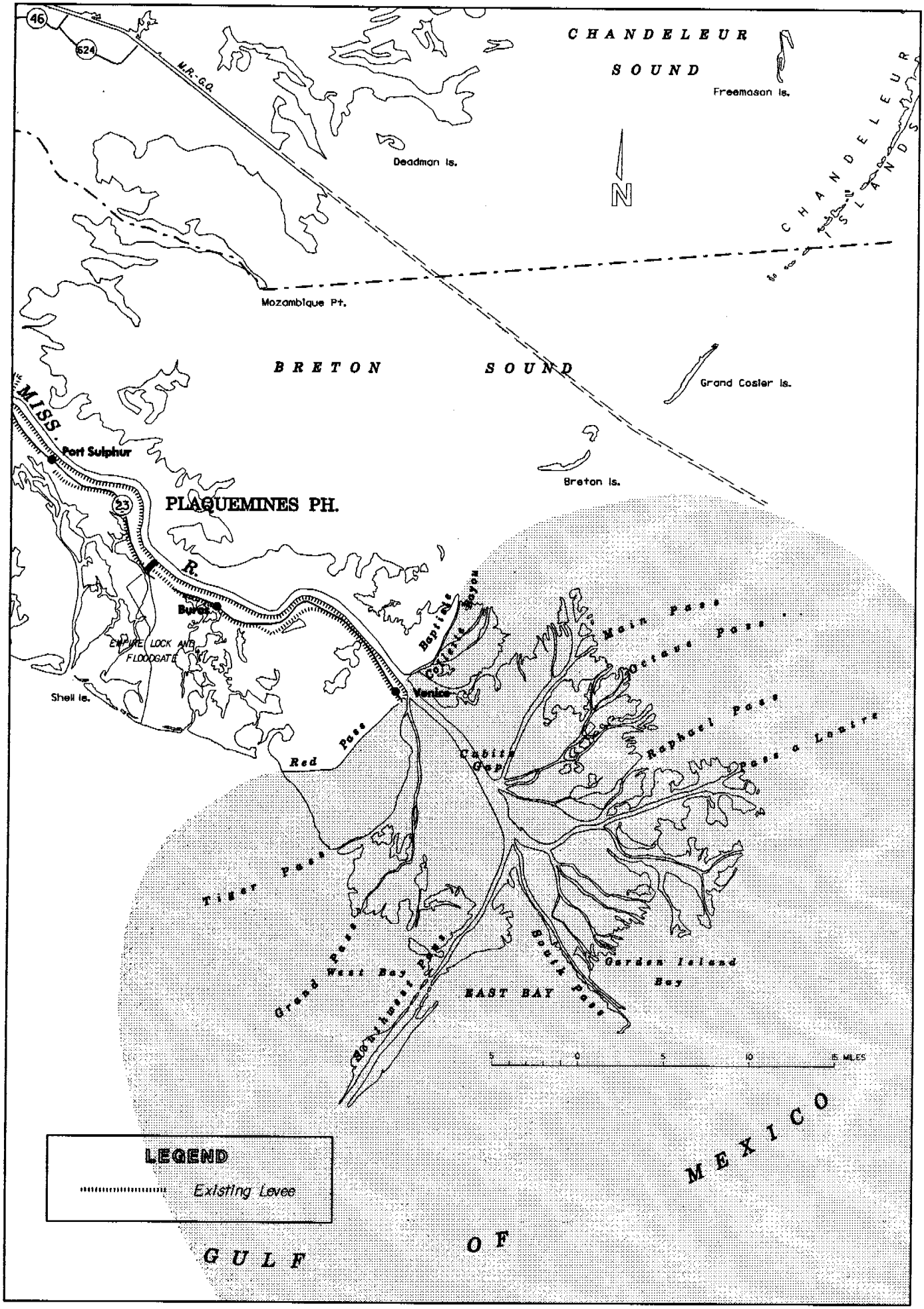


Figure 1. Mississippi River Delta Basin, Basin Boundaries.

of the Mississippi River and in Grand and Tiger Passes on the east side. The construction was completed in 1979.

The Mississippi River and Tributaries project, the comprehensive flood control project for the lower Mississippi Valley below Cairo, Illinois, has had a significant impact on the water and land resources in the Mississippi River Delta Basin. Features of the project pertinent to the basin are:

- The Mississippi River levees extend from Baton Rouge, Louisiana, to Bohemia, Louisiana, on the east bank and from above the study area to Venice, Louisiana, on the west bank. They provide protection from the standard project flood on the Mississippi River and Tributaries system. These levees are essentially complete in south Louisiana except in several locations where additional work is required to bring them to project grade and cross-section.
- The Bonnet Carre Spillway is located upstream of New Orleans, Louisiana, on the east bank of the Mississippi River in the vicinity of Norco, Louisiana. The purpose of the spillway is to divert Mississippi River flows to Lake Pontchartrain to lower flood stages in the Mississippi River in the New Orleans area. The spillway was completed in 1932.
- Revetments and foreshore protection have been constructed where levees or development are threatened by bank caving or where unsatisfactory alignment and channel conditions are developing. Foreshore protection is constructed where levees are threatened by the erosion of the batture. Construction of these features is continuing as needed.

U.S. FISH AND WILDLIFE SERVICE

The Department of the Interior, U. S. Fish and Wildlife Service, administers the 48,800-acre Delta National Wildlife Refuge. The refuge is located on the eastern side of the Mississippi River and is generally centered around Main Pass. Several small wetlands enhancement projects have been constructed in the refuge. These projects include small-scale sediment diversions, or crevasses. Some of these projects have been constructed with funds obtained for the mitigation of Federal and private activities in the refuge.

STATE OF LOUISIANA

The Louisiana Department of Wildlife and Fisheries administers the 66,000-acre Pass a Loutre Wildlife Management Area. The management area is generally bounded by Pass a Loutre, South Pass, and the Gulf of Mexico. Numerous small wetlands enhancement projects have been constructed in the management area. These projects include small-scale sediment diversions, or crevasses, and sediment retention measures. Sixteen of the small-scale crevasses have been constructed since 1986. Construction has been accomplished with funds from the State of Louisiana's Coastal Wetlands Conservation and Restoration Plan and through funds obtained for the mitigation of Federal and private activities in the refuge. Recently, sediment trapping fences were constructed in areas adjacent to some of the sediment diversion projects.

EXISTING CONDITIONS

GEOMORPHOLOGY AND HYDROLOGY

The Mississippi River has had a profound effect on the landforms of coastal Louisiana. The entire area is the product of sediment deposition following the latest rise in sea level about 5,000 years ago. During this period, the river shifted courses and formed major delta lobes that are discernible in the area. The major delta lobes, chronologically, have been: the Sale-Cypremort, the Cocodrie, the Teche, the St. Bernard, the Lafourche and the present day Plaquemines-Balize. The location of each of these delta lobes and their periods of activity are shown on Figure 2.

Each Mississippi River deltaic cycle was initiated by a gradual capture of the Mississippi River by a distributary which offered a shorter route to the Gulf of Mexico. Sediment deposition initially centered in the vicinity of the crevasse but extended gulfward to create a delta lobe. The lobe expanded as the river's new main channel enlarged, bifurcated, and reunited to form a network of distributaries bordered by natural levees and inter-distributary troughs. In the troughs, extensive swamps and marshes developed. Some distributaries were favored, while others were abandoned. Eventually, another crevasse would result in the abandonment of all or part of the delta lobe.

After abandonment, which would cut off the primary supply of fresh water and sediment, an area would undergo compaction, subsidence, and erosion. The old delta lobe would begin to retreat as the gulf advanced, forming lakes, bays, and sounds. Concurrently, a new delta lobe would begin its advance gulfward. This deltaic process has, over the past 5,000 years, caused the coastline of south Louisiana to advance gulfward from 15 to 50 miles, forming the present-day coastal plain.

In recent years, sediment deposition has occurred only at the mouth of the Mississippi River's Plaquemines-Balize delta, in the area defined as the Mississippi River Delta Basin. This delta is located on the edge of the continental shelf of the Gulf of Mexico. Its "bird's foot" configuration is characteristic of alluvial deposition in deep water. In deep water large volumes of sediment are required to create land area; and land is being lost in this delta more rapidly than it is being created.

Typical geologic profiles in the Mississippi River Delta Basin show the characteristic depositional environments of the deltaic plain. The upper Holocene sediments, deposited over the last 8,000 to 10,000 years, are very thick in the active Mississippi River delta when compared to other areas of the deltaic plain. Because the active delta is building out into deep water, Holocene sediments reach over 400 feet in thickness. The upper Holocene depositional environments include numerous active and abandoned distributaries and their associated natural levees, separated by inter-distributary and marsh deposits.

The natural levees are generally composed of oxidized silty clay and silt with higher compressive strengths and lower water content than the surrounding environments. Marsh deposits in the active delta consisting of organic and mineral sediments are up to 15 feet thick. They are underlain by inter-distributary deposits composed of soft to very soft clays with minor amounts of silt reaching thicknesses of up to 300 feet. Pro-delta deposits are located beneath inter-distributary deposits and consist of medium clays with minor amounts of silt reaching thicknesses of up

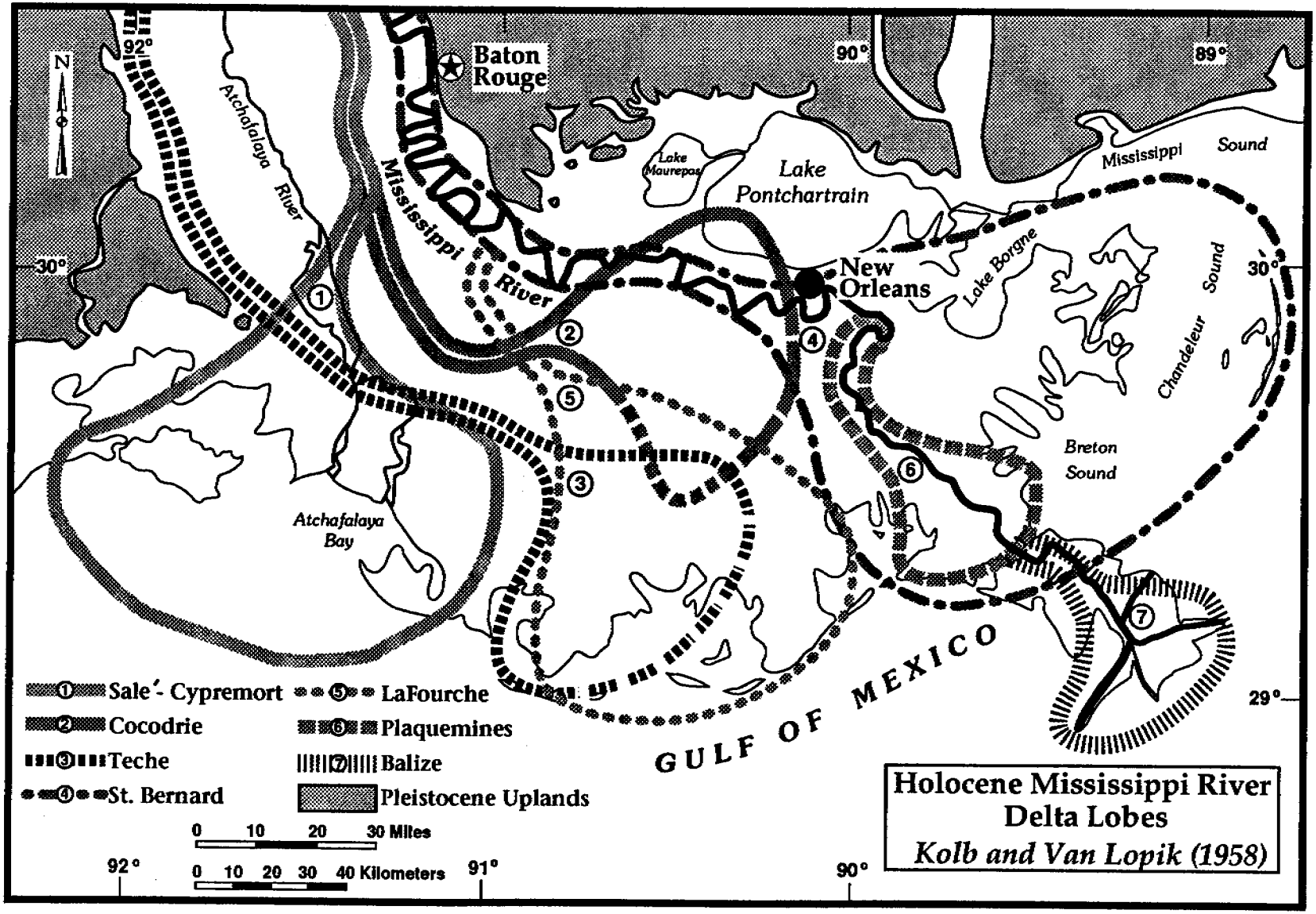

N
92°
90°
89°
30°
Baton Rouge
Atchafalaya River
Mississippi River
Lake Maurepas
Lake Pontchartrain
Mississippi Sound
New Orleans
Lake Borgne
Chandeleur Sound
Breton Sound
Atchafalaya Bay
GULF OF MEXICO
29°
① Sale'- Cypremort
② Cocodrie
③ Teche
④ St. Bernard
⑤ LaFourche
⑥ Plaquemines
⑦ Balize
Pleistocene Uplands
0 10 20 30 Miles
0 10 20 30 40 Kilometers
92°
91°
90°
Holocene Mississippi River Delta Lobes
Kolb and Van Lopik (1958)

Figure 2

to 150 feet in this area. Beneath the pro-delta are thin nearshore gulf deposits, approximately 10 feet thick, which are composed of sand and silt with some shell material. The Pleistocene surface underlying these nearshore deposits is located at approximately minus 400 feet National Geodetic Vertical Datum (NGVD).

Long-term subsidence rates in the geologic foundation of the active Mississippi River delta are not well documented, but probably exceed 4 feet per century in most of the area, which equal the highest found in coastal Louisiana.

Mississippi River.

The Mississippi River discharges the headwater flows from about 41 percent of the contiguous 48 states. Discharges in the Mississippi River average 470,000 cubic feet per second (cfs). A peak discharge of approximately 1,250,000 cfs occurs on the average of once every 16 years downstream of the Bonnet Carre Floodway located just north of New Orleans. A minimum discharge of 49,200 cfs was recorded at New Orleans, Louisiana, on November 1, 1939. Average annual high and low discharges are 1,050,000 cfs and 161,000 cfs, respectively.

These flows are confined to the river's channel by a man-made levee system for most of its length. This system extends below New Orleans, Louisiana, downstream to Bohemia, Louisiana, on the east bank of the river and to Venice, Louisiana, on the west bank of the river. In the Mississippi River Delta Basin, the river's discharges are generally distributed among its passes as shown below in Table 1.

Table 1. Distribution of Flow in the Passes of the Mississippi River

Name of Pass	Percent of Total River Flow
Southwest Pass	32
South Pass	17
Pass a Loutre	31
Cubits Gap	11
Grand Pass	5
Baptiste Collette	4

The Mississippi River flows are the primary influence on stages in the river at Venice, Louisiana, but during low discharges, tidal influences are significant. Stages in the river average 2.4 feet NGVD at Venice. The average annual high and low stages are 5.0 feet and 0.3 foot NGVD, respectively. Extreme stages have ranged from 9.11 feet NGVD on August 17, 1969, due to Hurricane Camille, to -0.64 foot NGVD on January 26, 1956.

Data on suspended sediment loads in the Mississippi River have been collected since 1949. Suspended sediment concentrations in the river decreased markedly between 1950 and 1966. Since that time the observed decrease in the suspended sediment load has been minimal. The decrease observed during the 1950 to 1966 time period is attributed to land use changes in the Mississippi River and tributaries watershed, to the construction of reservoirs in the watershed, and to the proliferation of channel stability measures put into effect on the river and its tributaries. Suspended sediment loads in the river average 436,000 tons per day and have ranged from an average of 1,576,000 tons per day in 1951, to a still considerable

average of 219,000 tons per day in 1988. Sediment in the river is ultimately delivered to the Gulf of Mexico, where it is deposited at the mouths of the river's passes.

Water quality in the Mississippi River is affected by the inflow of municipal and industrial effluents, non-point source discharges, and by saltwater intrusion during periods of low discharge. Sampling data indicate that pesticides, nutrients, heavy metals, and fecal coliform bacteria are of possible concern, along with lower temperatures and increased turbidity. However, water quality in the river has improved over the last decade.

Saltwater intrusion upstream of the Head of Passes frequently occurs during periods of low to moderate flow in the Mississippi River. The denser salt water flows upstream along the bottom of the river as fresh water flows downstream at the surface. The extent of this saltwater intrusion is influenced by flow duration, wind velocity and direction, tides, and riverbed configuration. The leading edge of the salt water flowing upstream on the river bottom is continually eroded by the fresh water flowing downstream at the surface, forming a "wedge" of salt water. The "toe" of this wedge extends upstream of the Head of Passes when freshwater discharges in the Mississippi River fall below 300,000 cfs. Because some mixing does occur at the fresh water-salt water interface, surface salinities downstream of the toe of the wedge become unsuitable for municipal and industrial use. Chloride concentrations exceeding the U.S. Environmental Protection Agency standard for drinking water may occur anywhere from 15 to 20 miles downstream of the toe of the wedge.

Gulf of Mexico.

The climate and water and land resources in this basin are significantly influenced by the Gulf of Mexico. Salinities in the gulf average 35 parts per thousand. The Gulf of Mexico is influenced by the global rise in sea level caused by the thermal expansion of water and the melting of glaciers. The historical rate of sea level rise is estimated at 0.46 foot per century.

VEGETATION AND SOILS

The Mississippi River Delta Basin comprises approximately 521,000 acres of land and shallow estuarine water area in the active Mississippi River delta. Based on data developed by the U. S. Fish and Wildlife Service, approximately 83 percent of this area, or 420,000 acres, is open water. The 101,100 acres of land in the basin are characterized by low relief, with the most prominent features being natural channel banks and dredged material disposal areas along the Mississippi River, its passes, and man-made channels. Coastal marshes make up approximately 61,600 acres, or about 61 percent, of the total vegetated area in the Mississippi River Delta Basin. About 81 percent of this marsh is fresh, 17 percent is intermediate, and 2 percent is brackish-saline. Sixteen percent of the vegetated area is agricultural lands, forests, and uplands. These areas are generally located on the natural levees of the river and its distributaries. Approximately 23,000 acres of submerged or floating aquatic vegetation accounts for the remaining 23 percent of the vegetated area of this basin. A breakdown of these acreages is provided in Table 2. Plate 1, located at the back of this appendix, displays the distribution of vegetative types in the basin. This information was developed from 1988 U.S. Fish and Wildlife Service data.

Table 2, Habitat Distribution
in the Mississippi River Delta Basin

Wetland Type	Acres
Fresh Marsh	49,730
Intermediate Marsh	10,710
Brackish Marsh	430
Saline Marsh	780
Total Marsh	61,650
Aquatic Vegetation*	23,050
Other	16,420
Water	419,450
TOTAL AREA	520,570

* Aquatic Vegetation includes both floating and submerged beds.

FISH AND WILDLIFE RESOURCES

Fishery resources include freshwater and marine species. Commercially important species are shrimp, oysters, menhaden, blue crab, Atlantic croaker, sea trout, spot, and red drum. Sport freshwater species include large-mouth bass, crappie, catfish, and various species of sunfish.

Threatened and endangered species within the basin include the bald eagle, arctic peregrine falcon, brown pelican, piping plover, and several species of sea turtles. Bald eagles currently do not nest in the basin, but wintering eagles have been observed foraging in these marshes. Arctic peregrine falcons are regular winter residents. They forage in the basin's wetlands, feeding predominantly on shorebirds and waterfowl. Brown pelicans forage in the shallow ponds and bays of the basin. They have also been observed nesting on the mud lumps near the mouth of the Mississippi River. Piping plovers commonly winter along the Gulf of Mexico shoreline. The highest concentrations of these species in Louisiana are on the barrier islands, but they may be found within this basin feeding along the inter-tidal zone and mud flats of the gulf shoreline. The hawksbill, Kemp's ridley, green, and leatherback sea turtles utilize the nearshore waters of the Gulf of Mexico, primarily as foraging habitat.

Included in the wildlife resources are game and non-game animals and commercially important furbearers and alligators. Because of the abundance of nutria and muskrat along the coastal areas, Louisiana leads the nation in fur production. Both birdwatchers and sportsmen enjoy the great variety of birds in the marshland. These wetlands also provide wintering habitat for waterfowl using the Mississippi Flyway.

ECONOMIC RESOURCES

The flood control and navigation projects that contributed to the loss of wetlands in coastal Louisiana also made a large portion of this area inhabitable and fostered economic development. The economy of southeast Louisiana is founded on a base of natural resources that include commercially important minerals and a

variety of fish and wildlife resources. With an extensive system of navigable waterways, which center around the Mississippi River, and a strategic location, the area accessed by way of the river's passes is a hub for foreign and domestic trade. As a result, the area harbors a cultural and historical heritage that ranks alongside the most significant in the nation.

Mineral Extraction.

Mineral production is a multi-billion dollar a year industry in the state of Louisiana. Within a short radius of the Mississippi River Delta Basin, a billion dollars or more of mineral production occurs each year. Crude petroleum and natural gas are among the most significant of these resources and account for 80 to 90 percent of the total value. The volumes of both petroleum and natural gas produced within the immediate vicinity of the delta amount to a significant percentage of the national production. Sulfur, salt, and natural gas (liquid) are abundant in the basin.

Many related industries have located along the deepwater reach of the Mississippi River between Baton Rouge, Louisiana, and the gulf. In 1973 the estimated total investment was approximately $9 billion. Many of these industries deal in the processing and production of bulk materials, including refined oil products, chemicals, synthetic rubber, plastics, alumina, sugar, sulphur, and nickel-cobalt.

Port Activities.

The lower Mississippi River is the deep-draft navigation route for the Ports of New Orleans, Baton Rouge, South Louisiana, and Plaquemines. The Port of South Louisiana, which incorporate the reach of the Mississippi River from Baton Rouge to New Orleans, ranks number one in the United States based on tonnage shipped through its facilities. These ports have been dominant factors in the economy of southeast Louisiana, and the state as a whole, adding millions of dollars annually to the state's treasury and providing thousands of jobs. It is estimated that the economic effect of these ports totals over $10 billion annually.

Deep-draft navigation access between the Mississippi River and the Gulf of Mexico is provided via a channel in the river's Southwest Pass. This channel and an approximately four mile reach of the Mississippi River upstream of Southwest Pass must be maintained by dredging. This maintenance dredging has been estimated to cost $10.6 million annually. Reaches of the river immediately above this location are maintained hydraulically by the normal river flows.

The Mississippi River and Southwest Pass within the Mississippi River Delta Basin area are utilized by oceangoing and shallow-draft vessels comprising a wide range of sizes and types. Shallow-draft vessels include barge tows, commercial fishing boats, oil field crew and supply boats, offshore drilling vessels, and pleasure craft. The oceangoing vessels include dry bulk carriers, tankers, and general cargo vessels. The drafts of vessels moving through the passes of the Mississippi River vary significantly, ranging from less than 20 feet up to in excess of 40 feet. There are approximately 8,000 oceangoing vessel trips through Southwest Pass annually.

Oceangoing commerce on the Mississippi River was approximately 200 million tons in 1990. The oceangoing commerce is a highly diversified mix of commodities, exceeding 100 different products. Dry bulk cargo is of primary importance, including

grain, soybeans, coal, salt, iron ore, and phosphate rock. Liquid bulk commodities include crude petroleum, refined petroleum products, and agricultural and industrial chemicals.

Fish and Wildlife Activities.

Important activities center around the fish and wildlife resources. Major commercial fishery species include shrimp and menhaden. Other fish species important to the seafood industry are blue crab, Atlantic croaker, sea trout, spot, and red drum. Menhaden is the principal industrial fish taken in Louisiana. Its processed, oily flesh is a valuable source of oil and animal feed. The average annual menhaden harvest is 238 million pounds. The average annual harvest of other fish species is 28 million pounds. The oyster, shrimp, menhaden, and other fishery resources support a host of other seafood related industries. Commercial wildlife activities in the basin are associated mainly with alligators and furbearers, including muskrat, nutria, raccoon, and otter.

COASTAL WETLANDS PROBLEMS

Recent land loss rates in the Mississippi River Delta Basin have averaged 1,072 acres, or 1.69 percent of existing land area, per year (Dunbar, Britsch and Kemp, 1992). Between the mid-1950's and 1974, the estimated land loss rate for the basin was 2,890 acres per year. This loss is the result of compaction, subsidence, hurricanes, tidal erosion, sea level rise, and human activities. The loss has been aggravated by maintenance of navigation channels and construction of canals for mineral exploration. The total land area lost in this basin over the last 60 years has been approximately 113,300 acres. A break-down of the historic wetland loss in the Mississippi River Delta developed from USACE data is shown in Table 3 below.

Table 3. Historic Wetland Loss in the Mississippi River Delta Basin

Time Period	Total Acres Lost	Percent Lost Per Year
1932-1958	49,928	1.20
1958-1974	46,237	2.63
1974-1983	8,021	1.40
1983-1990	9,125	2.35

The primary wetlands loss problem facing the Mississippi River Delta Basin is that of subsidence and compaction. Unlike other areas of coastal Louisiana, the Mississippi River delta is blessed with a relative abundance of inflowing fresh water and sediments. Despite the availability of these resources the overall growth of emergent delta has been truncated in recent history. In this area of the deltaic plain the Mississippi River deposits sediments into much deeper water than are found in areas nearer the pleistocene terrace to the north. This is evidenced by the thick stratum of Holocene deltaic sediments found in the active river delta. These unconsolidated sediments are highly susceptible to compaction, reducing the life span of emergent wetlands. While the rapid emergence of wetlands can occur over large areas in the delta, these areas deteriorate in an equally rapid manner.

Human activities have aggravated land loss rates in the Plaquemines-Balize delta. The stabilization of the Mississippi River's channel has cut off seasonal sediment-laden overbank flow that once nourished adjacent wetland areas. The Mississippi River levees to the north, and associated erosion control and channel stabilization measures extending to its mouth, also preclude the possibility of a naturally occuring crevasse or change in the river's course.

In the Mississippi River Delta Basin area of the delta, the construction and maintenance of the deep-draft navigation project has resulted in the channelization of the Mississippi River and Southwest Pass, which diverts more of the sediment to deep water areas. In the past the rapid rate of deposition was able to keep pace with or exceed subsidence, resulting in development of emergent marsh. Since prior to the 1960's, soil conservation practices, numerous streambank stabilization projects, sediment retention structures on tributary streams, and multi-purpose dams on several major streams and their tributaries have contributed to an approximately 46 percent decrease in the suspended sediment load reaching the Mississippi River delta (U.S. Army Corps of Engineers 1981). This reduced sediment load has contributed to the high rates of wetlands loss.

Because so much of the land area in the Mississippi River Delta Basin is exposed to wave and current action from the Gulf of Mexico, shoreline erosion is also an important cause of wetland loss. High rates of subsidence also increase shoreline erosion by increasing the area exposed to wave and current action. Shoreline erosion has been especially severe between Sandy Point and Tiger Pass on the west side of the basin and near the mouths of Southeast Pass, Pass a Loutre, and Southwest Pass.

Many areas of the Louisiana coast suffer from a lack of the abundant fresh water and sediment found in the Mississippi River. Since the river is no longer free to alter its course and leave its banks to inundate vast coastal areas, the effects of human and natural forces which promote wetland deterioration are compounded. In this respect the relationship between the Mississippi River and the problems facing coastal wetlands is not limited to the river's delta, but extends across the entire Louisiana coast. The lack of growth in the Mississippi River delta, on a large scale, is as much a coast-wide problem as a basin problem. This source of ample fresh water and sediment, which shaped the Louisiana coast as we know it, is no longer producing a net gain in coastal wetlands, placing the entire Louisiana coast at risk.

FUTURE WITHOUT-PROJECT CONDITIONS

WETLAND CHANGES

The balance between the rates of deposition and subsidence plays an important role in determining how much land gain or loss will occur in the active Mississippi River delta. Water levels and sediment concentrations in the river help to determine the deposition side of this balance. No further significant natural changes in the distribution of the Mississippi River's sediments are expected over the next 50 years. Most of the sediment will continue to be delivered to the gulfward extent of the existing delta, where it will deposited in relatively deep water or be reworked along the coast by the prevailing winds.

Since 1932, the Mississippi River Delta Basin has lost approximately 70 percent of its total land area, the most significant portion of which was wetlands. The

location of the land loss in this basin over the last 35 years is displayed in Figure 3. A composite loss rate, based on the 1974 to 1990 time period and using USACE data, was developed for predicting future wetlands loss. This yielded a predicted future average wetlands loss rate of 1,072 acres per year. Future loss rates are difficult to determine because water levels and the coincident deposition of sediment can fluctuate greatly over time.

Projections of losses were made for 20- and 50-year time spans. Coastal Wetlands Planning, Protection and Restoration Act projects are compared based on a 20-year project life. Separately authorized civil works projects providing wetlands benefits, which have been included in the plan, were developed based on a 50-year project life. Total losses projected over the 20- and 50-year time spans are 21,440 acres and 53,600 acres, respectively, and are presented in Table 4 below. These losses represent 35 and 87 percent of the existing wetlands, respectively. Based on this loss of wetlands, only 5 percent of the original 1932 land area in this basin would remain intact in 50 years.

Table 4. Projected Wetland Loss in the Mississippi River Delta Basin

Projected Time (years)	Acres Lost	Percent Lost
20	21,440	35
50	53,600	87

FISH AND WILDLIFE RESOURCES

Because loss of habitat in the delta is tempered by the influx of large quantities of fresh water and nutrients, it is anticipated that the fish and wildlife resources present in the area will experience a gradual decline in both quantity and quality. However, given this large input of sustaining resources, biological productivity falls far below the level of gain that should be expected within the Mississippi River delta. This lack of efficiency in converting the naturally available resource into wetlands primarily affects waterfowl and land-dwelling species. The deterioration of the wetland vegetation in this basin will ultimately result in a decline in the numbers of these animals as well as other species due to reduced food sources or nesting habitat. For some species the cumulative impact may be felt beyond the immediate area of the Louisiana coast.

A gradual decline will occur in the larger land dwelling species, such as white tail deer, and furbearers due to the net loss of wetlands. These biological resources are also adversely affected by the occurrence of extreme meterological episodes because they affect wetland habitat. The impact of these events will become more pronounced in the future given the wetland's limited potential for recovery and regeneration.

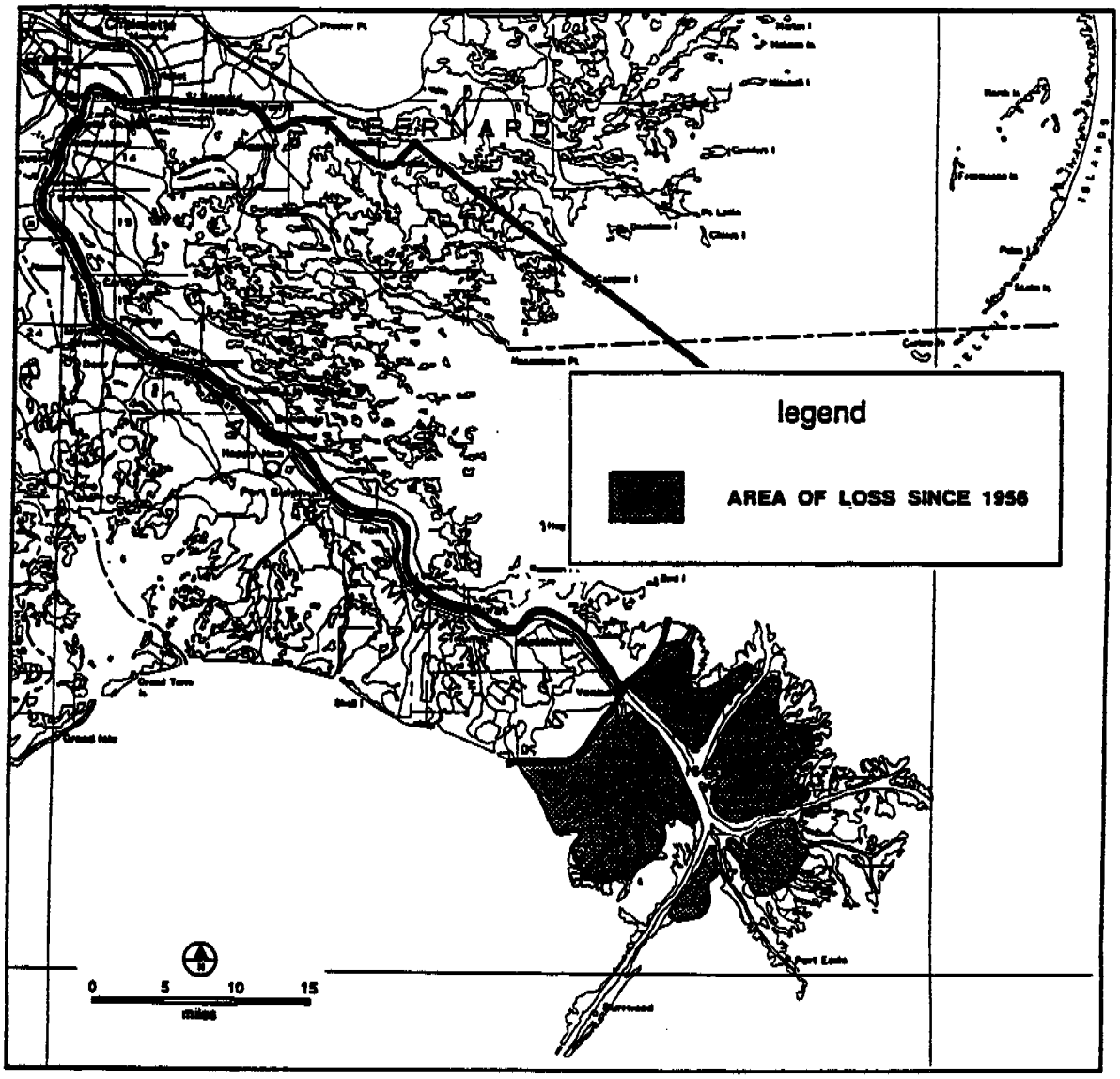


Figure 3. Primary areas of wetland habitat change in the Mississippi River Delta.

ECONOMIC RESOURCES

The overall economy of the basin is expected to continue to prosper as a result of the mineral extraction and port activities of the area. The deterioration of wetland habitat in the existing delta will have minimal tangible effect on these activities. Some serious intangible effects involved with the loss of wetlands throughout the delta would be reduced navigation safety and channel maintainability.

Habitat deterioration is expected to reduce the productivity of commercially and recreationally important species by one quarter to one third. This would come as a result of reduced vegetative food sources for both land and marine dwelling species. Ultimately this effect would propagate throughout the food chain in this area. Industries associated with the production of wildlife and fisheries resources, which are of primary importance to this planning effort, will also decline.

Wetlands deterioration may also ultimately result in increased flood protection requirements for maintaining industrial and municipal infrastructure. The loss of wetlands as natural abatements to flooding may ultimately result in increased costs associated with flood insurance and disaster relief.

PLANNING OBJECTIVES FOR THE BASIN

The objective developed for the Mississippi River Delta Basin through the interactive plan formulation process emphasizes the beneficial application of available resources. The unique opportunity present in this basin is the tremendous volume of sediment transported by the Mississippi River. The need which must be addressed with this resource is not limited to only this basin. The needs of the entire coast of Louisiana are linked, inseparably, to the one-of-a-kind opportunity that the Mississippi River presents.

The objective for this basin is to distribute the flows and sediments in the Mississippi River for the purpose of creating and sustaining wetlands in the most effective manner possible. While this objective seeks to retain and expand existing wetlands in the basin, it also recognizes that substantial gains may come at the expense of some existing wetlands. The desired outcome of this objective is to attain long-term positive wetland growth rates, similar to those historically experienced in the Mississippi River deltaic plain.

STRATEGIES CONSIDERED

Development of the major strategies for the Mississippi River Delta Basin reflects certain principles established for the entire coastal area. In particular, the primary goal for the Louisiana coast involves the maintenance and restoration, where feasible, of natural processes. Principal among these is the restoration of historic fluvial processes in as near a natural manner as possible. This will involve the distribution of Mississippi River flow and sediments over vast areas of wetlands and open water bottoms and necessitates the consideration of large-scale projects. The determination of the appropriate location and magnitude for such efforts will be a substantial undertaking in its own right.

However, a complete restoration of coastal Louisiana to the conditions present many decades ago is not a realistically achievable goal. In some areas of coastal Louisiana an intermediate level of restoration must be sought and secondary strategies must be adopted in order to arrive at viable conceptual alternatives. These strategies involve the utilization of the resources available to support areas of critical need or significant opportunity, to preserve wetland functions at their current level.

As a result, a short-term strategy for utilizing the Mississippi River's resources was developed to function as a subset of either major strategy. The short term strategy will be to introduce and capture flow and sediments on a smaller scale throughout the existing delta. This will allow the stabilization and enhancement of these existing wetlands, which may have to be sacrificed over the long term to achieve net wetland gains.

Considering the planning objectives of the Mississippi River Delta Basin, two alternative strategies were developed. Both of these strategies would involve impacts to the maintenance of navigation to varying degrees. In both alternatives the route of navigation would remain in Southwest Pass and the existing river channel.

Strategy One.

Strategy One would provide for the investigation and development of an uncontrolled diversion of the Mississippi River for the creation of a new delta, while managing the retreat of the existing delta and maintaining navigation along the present route. This investigation would look into all viable options for undertaking the relocation of the river's primary delta. The restoration plans in both Breton Sound and Barataria Basins are compatible with some form of large scale diversion. At this time the principal site for consideration is the Breton Sound although others will be considered.

Locks or systems of locks for navigation, although a viable option, have been shown to be a less desirable alternative despite maximizing the volume of flow diverted. A system of long chamber locks have been suggested by a number of interests; however, previous studies have shown that, using current technology, the first cost for this type of navigation system would be much greater than that for an open channel system. An additional negative economic factor in considering navigation locks, aside from induced time delays, is the potential for loss of traffic through the ports.

In managing the retreat of the existing delta, small to moderate wetland creation projects can be undertaken in the near term. These projects would serve to expand and stabilize the existing wetlands in the delta prior to the onset of its retreat. In addition, a long range Dredged Material Disposal Plan for the Mississippi River Delta would coordinate maintenance and dedicated dredging projects in order to enhance the disposal of this material for the long-term conservation of the existing delta. The purpose of this program would be to promote the development of barrier islands in the delta after its abandonment. This should not be construed to mean the artificial creation of barrier islands. The intent of this program would be to insure an adequate base or supply of material, in appropriate locations, in order to accelerate the natural formation of these features. This would ultimately stabilize and anchor the area after the river is diverted.

Strategy Two.

Strategy Two would maintain the course of the river in its present location and optimize the growth of the existing delta through redistribution of the available flows and sediments in the delta. This strategy would expand upon the short term strategy, and the concept of managing delta retreat as proposed under Strategy One, aggressively pursuing small to moderate marsh creation projects on a broad scale throughout the existing delta. The goal of this strategy would be to maintain the existing delta by maximizing the available sediment resource and achieving a dynamic equilibrium of loss and gain.

RATIONALE FOR SELECTED PLAN

The selected plan, based on Strategy One, is pursuit of the full scale uncontrolled diversion of the Mississippi River. The purpose of such a diversion would be to utilize the river's flow to distribute its sediment load to a shallow water estuary for creation of a new delta. Significant prior study will be required to enable the execution of this plan. This study will almost certainly require separate, or additional, funding and authority. The concept of this diversion has been previously investigated at a reconnaissance level in the Louisiana Coastal Area,

Mississippi River Delta Study, completed by the U. S. Army Corps of Engineers, New Orleans District, in February 1990. This information should provide the basis for the next study level, a detailed feasibility study.

The crucial points for the selection of the diversion plan, Strategy One, over Strategy Two, maintenance of the existing delta, are the extent of the benefits which can be achieved and the long term optimization of available resources. The diversion of the river's main flow translates into large gains in newly emergent wetlands over potentially hundreds of years, while the maintenance and enhancement of the existing delta is geologically limited to the reclamation of a defined area of wetlands. The efforts required to achieve the optimum gain through each of these alternatives are contrasted by the need to execute a single major action with Strategy One, as compared to numerous small, and necessarily repetitive, actions with Strategy Two. The major strategic effects of the selected plan on the coastal zone are presented in Figure 4.

Adverse impacts to the maintenance of navigation must be addressed with either strategy, and it should be recognized that the existing delta, if left to natural processes, would be ultimately abandoned and its wetlands lost. It is also important to note that the same near-term measures can be implemented under either primary strategy. Many of the measures which can be taken to enhance the current delta configuration under Strategy Two will, in some scaled form, be used in preparing the existing delta for a diversion of the river and in managing its retreat under Strategy One. This allows the execution of the plan to proceed in the short term regardless of the feasibility of the major diversion feature.

The significance of the available resources and the present lack of net delta growth are magnified in view of the extent of the larger wetland loss problem in coastal Louisiana. This is apparent in a present day context and historically. The selected plan represents an aggressive approach that would initiate the growth of a new delta. The basis for the selection is that the resource available in the Mississippi River must not be under-utilized in the rebuilding and maintaining of the Louisiana coast. To achieve the goal of maintaining the current level of wetland functions and to offset the high rates of wetland loss, measures which net large gains in coastal wetlands must be pursued. With this alternative, the transition from a restoration posture of status quo to one of aggressive rebuilding is achievable.

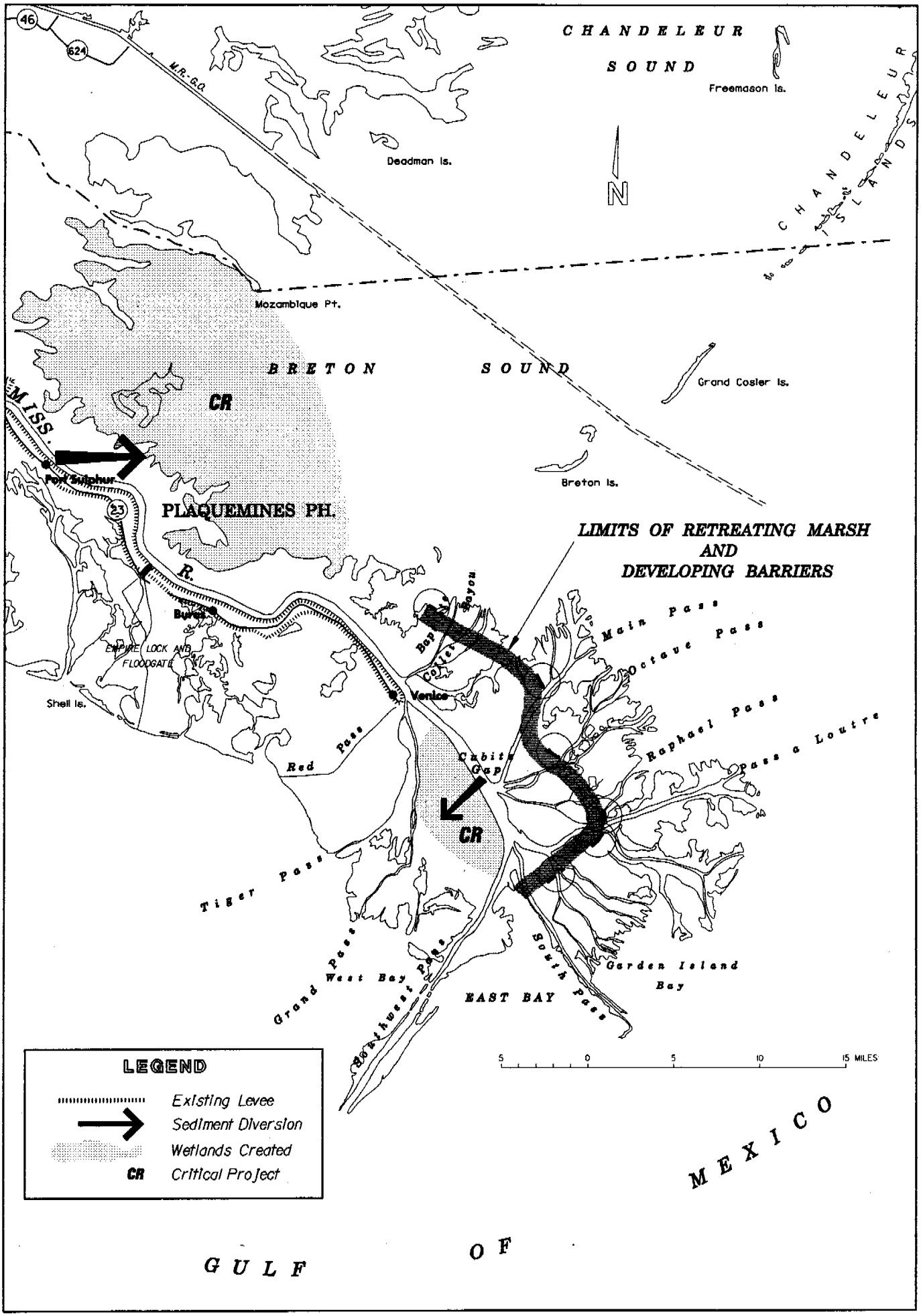


Figure 4. Mississippi River Delta Basin, Strategy Map.

COMPONENT PROJECTS

The principal project in the selected plan for the Mississippi River Delta, the Uncontrolled Mississippi River Diversion, is considered critical but will require a detailed feasibility study. Given the magnitude of the action prescribed in this alternative, decades may pass prior to any construction beginning. The description of this critical project is based on the most conservative alternative outlined in the best available source of information. The description is intended to describe the available information on potential project scope, cost, benefit, and impact. The proposed studies will expand on this information, enabling selection of the most appropriate features.

Additional studies would assess this plan versus long-term net losses for the entire Louisiana coast without a major action of this nature. An action of this magnitude would have net benefits reaching far beyond a 20-year, or even 50-year, project life. With the diversion, deep-draft navigation would remain in the Mississippi River's present channel, where the industrial development requiring deep-draft access is located. Any major reduction in the flow of the Mississippi River will result in a reduction of the naturally maintained channel. This would in turn result in increased dredging requirements. This is an area of major impact, and increased requirements for maintenance of navigation must be quantified.

Equally important topics which must be studied under the selected plan include the deterioration and retreat of the existing delta. Achieving a smooth transition, and a long-term net gain in acreage, from one delta area to the other is a specific concern and requires verification. Additionally the effects of the diversion on the receiving area would require study and verification due to the large influx of fresh water.

A second project which is considered critical, due to its potential importance as an operating model of the principal project, is the West Bay Sediment Diversion. This smaller project also functions to support the selected plan.

As mentioned, a major concern in the implementation of the selected plan is the transitional loss of wetlands and biological productivity in the existing delta. The retreat of the wetlands in the existing delta, following diversion of the major portion of the river's flow, will need to be managed to minimize immediate adverse impacts. The selected plan includes a number of supporting projects to stabilize the existing delta in the near term. The supporting projects would enhance wetland development in the existing delta prior to the implementation of a major diversion and would actively counter the impacts of encroaching marine processes following diversion. In addition to execution of these specific projects, the concepts they entail may be duplicated in the future at other locations as needed to support the basin restoration objectives. With timely and judicious execution of supporting projects, short-term wetland gains can be achieved, and sudden catastrophic losses can be avoided over the long term.

PRIORITY LIST PROJECTS

Two projects were selected from this basin for the first CWPPRA Priority Project List (PPL). The West Bay Sediment Diversion project is presently under going model investigations. The Tiger Pass Dredged Material Disposal project was given a

deferred status. This status indicates that the project would be constructed should one of the primary projects on the list prove to be unexecutable.

The second PPL included a single project from this basin, the Pass a Loutre Sediment Mining project. This project also received a deferred status. Subsequent to the submission of the second list, and in lieu of its deferred status, this projects features and location were incorporated in another project. Currently an alternate site is being developed for this project.

The third PPL includes two additional projects from this basin. The Pass a Loutre Crevasse project, which includes the features of the sediment mining project, and the Channel Armor Gap Crevasse project are now under going detailed engineering and design.

LONG-TERM CRITICAL PROJECTS

This category is indicative of measures critical to the restoration of the basin. These projects implement the chosen strategy for the basin but require a lengthy and rigorous development process and entail high construction costs. The studies necessary to bring these projects to a point of executability are afforded a high priority because of the core nature of these projects to the restoration plan. In the Mississippi River Delta Basin there is only one project in this category.

PMR6, Uncontrolled Diversion of the Mississippi River

SHORT-TERM CRITICAL PROJECTS

This category includes projects which are immediately executable and also directly address the implementation of the principal strategy for the basin. In addition these projects may require immediate execution in order to preserve or sustain wetlands, and their functions, at existing levels. In this basin there is only one project in this category. Although there are similar projects in subsequent categories, this project provides a model for the implementation of all similar projects, both short and long term. This project has already been placed on a Priority Project List.

FMR3, West Bay Large Scale Sediment Diversion (PPL1)

SHORT-TERM SUPPORTING PROJECTS

Projects in this category are immediately implementable. These projects meet the objectives of the basin plan but do so by supporting secondary strategies. In some instances these projects support the principal strategies but at a significantly reduced scale or over an expanded timeframe. A number of the projects in this category have been placed on Priority Project Lists.

FMR4, Tiger Pass Dredged Material Disposal (Deferred PPL1)
PMR8, Pass a Loutre Sediment Mining (Deferred PPL2)
PMR8/9a, Pass a Loutre Crevasse (PPL3)
XMR10, Channel Armor Gap Crevasse (PPL3)

Additional small scale sediment diversions, similar to those in Priority Project List 3, will receive wide use in support of this plan.

(Short Term Supporting Projects, continued)

MR2, Pass a Loutre Sediment Fencing

Additional projects utilizing this technique may be broadly applied in a support role

PMR5, Benneys Bay Large Scale Sediment Diversion

XMR11, Vegetative Planting

While no site specific projects are proposed at present projects of this type are readily executable and would support the objectives of this plan.

LONG-TERM SUPPORTING PROJECTS

Long-term supporting projects are those which require a lengthy and rigorous development process or entail a high cost to construct. These projects do not address the primary strategy but support secondary strategies to enhance the total restoration of the basin. While these projects assume the lowest priority in the selected plan, some do, however, provide wetland benefits on a significant scale.

XMR14, Mississippi River Delta Dredged Material Disposal Plan

PMR7, Mississippi River Passes Flow Redistribution

XMR13, Bohemia Sediment Diversion

XMR12, Beneficial Use of Hopper Dredged Material (R&D)

COSTS AND BENEFITS

The benefits for the major project in this plan, the Uncontrolled Mississippi River Diversion, will be accrued in some other coastal basin. For the purpose of comparison with short-term projects (20 years), the costs and benefits of this project are estimated to be $428,720,000 and 61290 acres. This project costs $910,000,000 and creates 89,300 acres over, a more reasonable, 50 year project life. However, once in place this project will continue to function well beyond 50 years after its construction, resulting in additional benefits and requiring continued maintenance. These benefits represent a significant reduction of wetlands loss from a coastal standpoint; however, they cannot be applied directly to the prevention of wetlands loss in this basin.

The direct costs and benefits of the selected plan in this basin are $23,910,000 and 24,600 acres respectively. Based on these benefits, the selected plan will eliminate all projected wetlands loss and produce a net gain of 3,160 wetland acres over 20 years.

Costs and benefits have been roughly estimated for the long term Bohemia Sediment Diversion project; however, this project would serve as a precursor or alternative to the critical Uncontrolled Mississippi River Diversion project. Because of this overlap the costs and benefits of the larger, more crucial project have been provided. The specific costs and benefits for known projects can be found in Table 5, which includes all projects in the selected plan, located at the end of this section.

The benefits of most of the projects included in this total were estimated according to a modified rapid-assessment Wetland Value Assessment (WVA) protocol. These assessments were based, in part, on project-specific information which varied in quantity and quality among projects. These estimates are therefore rough approximations, considered preliminary to a more in-depth assessment, and should be interpreted and used as such. The benefits for those projects which have been placed on a Priority Project List were developed using an in-depth WVA. The

quantification of these projects' benefits has been, necessarily, much more rigorous. The costs and benefits for the selected plan include only those projects with established designs. These include the long- and short-term critical projects and all short term supporting projects with the exception of any Vegetative Planting projects.

KEY ISSUES IN PLANNING

In the development of major strategies for this basin, measures to accommodate deep-draft navigation access between the Mississippi River and the Gulf of Mexico were of major concern. With a significant portion of national commerce dependent on deep-draft navigation, access between the river and the gulf must be maintained without significant disruption. Any major reduction in the flow of the Mississippi River will result in a reduction of the naturally maintained channel. This would in turn result in increased dredging requirements.

Other important areas of impact exist under Strategy One. One would be the deterioration and retreat of the existing delta. The presence of the Delta National Wildlife Refuge and the Pass a Loutre Wildlife Management Area in the existing delta makes this an area of major concern for both state and Federal wildlife and fisheries authorities. Achieving a smooth transition, and a long term net gain in acreage, from one delta area to the other is a specific concern and requires verification. The effects of the diversion in the receiving area also require study and verification. In Breton Sound, for example, a large number of oyster grounds and the Breton National Wildlife Refuge at its gulfward extent would be affected by the influx of fresh water.

Beyond these concerns a key issue to be addressed in this basin has ramifications for all of coastal Louisiana. The implementation of large measures necessary to overcome present wetlands trends requires a change in the basic philosophy for the selection and execution of environmental projects. Significant impacts to wetlands may be traced to existing projects intended for the protection or enhancement of long-term economic investment, both private and public. The decision to invest public funds in these projects has historically been based on the ability of the project to provide a positive level of benefits measured in economic terms over a relatively short project life span--traditionally 50 years. In many cases the effects of these projects on their surrounding environment were estimated no further than this same life span. These estimates have fallen well short of the actual accumulated impacts in some cases, particularly when viewed in the context of a geologic time frame such as the natural life span (roughly 1,000 years) of a river delta.

The Mississippi River, as the fifth largest hydrologic drainage on earth, provides a resource of a global proportion. With a sediment output of millions of tons annually, the Mississippi River is responsible for the geology of the Louisiana coastal zone from Vermilion Bay to Mississippi Sound. The present day utilization of this resource exhibits the manner in which the management of a significant resource to support one unique set of goals may lead to critical deficiencies and needs in meeting alternative goals.

The system of balance found in nature provides for constant fluxes of gain and loss. This simultaneous occurrence of perceived positive and negative trends in the environment allows for a fluctuating state of equilibrium. In attempting to simulate this balance, while continuing to provide protection to long-term

economic investment, it is essential to recognize that present environmental conditions are not static, and that changes, both positive and negative, are unavoidable if long-term equilibrium is to be maintained. In the context of creating new emergent wetlands, these changes may well represent negative effects to the users of a specific resource. The impacts may occur as a loss or relocation of a resource from a geographic area. However, these impacts are ultimately not permanent and trade-offs may be achieved in a net gain of alternate resources over the larger time frame.

The perceived disparity between the initially analyzed and actual long-term effects of existing water resources projects has emphasized the need to re-establish the essence of historically occurring natural processes. To accomplish this, a more farsighted philosophy for the recommendation, development, and execution of environmentally-oriented projects is needed. Simply stated, the philosophy necessary for successfully undertaking environmental restoration is to look beyond traditional short-term analyses of costs and benefits. The true benefits of these restoration efforts lie, beyond their immediately apparent effects, in the long-term gains which ultimately provide the equilibrium necessary for the long-term conservation of coastal Louisiana.

Many issues are involved in executing such an aggressive alternative, and concerns exist in every conceivable area of planning. The environmental, economic and social impacts are of major concern, along with significant engineering and design, real estate, and legal issues to be addressed. However, the consequences for future generations, if these issues are not faced now, far outweigh the immediate impacts.

Table 5. Summary of the Mississippi River Delta Projects

Project No.	Project Name	Project Type	Priority List Project	Acres Created, Restored or Protected	Net Benefited Acres	Estimated Cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Critical Projects, Short-Term								
FMR-3	West Bay Large Scale Sediment Diversion	SD	PPL1	9,831	10,722	6,328,000	600	
Critical Projects, Long-Term								
PMR-6	Mississippi River Channel Relocation	SD		89,300	89,300 *	910,000,000	10,200	50 Year Cost
				61,290	61,290	428,720,000	7,000	20 Year Cost
Supporting Projects, Short-Term								
MR-2	Pass A Loutre Sediment Fencing	ST		1,500	1,817	2,666,000	1,500	
FMR-4	Tiger Pass Dredged Material	MC		415	457	4,434,000	9,700	Deferred from PPL 1
PMR-5	Benny's Bay Sediment Diversion	SD		10,761	12,125	6,328,000	500	
PMR-8	Pass A Loutre Sediment Mining	MC		118	252	1,247,000	4,900	Deferred from PPL 2
PMR-8/9a	Pass a Loutre Crevasse	SD	PPL3	1,043	1,287	2,242,000	1,700	
XMR-10	Main Channel Armour Gaps	SD	PPL3	936	1,219	665,000	500	
XMR-11	Vegetative Plantings	VP						
Subtotal Supporting Projects, Short-Term				14,770	17,160	17,582,000		
Supporting Projects, Long-Term								
PMR-7	Mississippi River Passes Flow Redistribution	HR						
XMR-12	Beneficial Use of Hopper Dredge Material	MC						
XMR-13	Bohemia Sediment Diversion	SD		3,350	3,350 *	3,118,000	900	
XMR-14	Mississippi River Dredged Material Disposal Plan	MC						

Table 5. Summary of the Mississippi River Delta Projects

Project No.	Project Name	Project Type	Priority List Project	Acres Created, Restored or Protected	Net Benefited Acres	Estimated Cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Projects Not In Restoration Plan								
PMR-1	Riverside Bay Island	MC		55	55 *	1,650,000	30,000	
Total Mississippi River Delta Basin **				24,600	27,880	23,910,000		
Total Mississippi River Delta Basin ***				85,890	89,170	452,630,000		

HR Hydrologic Restoration
MC Marsh Creation w/Dredged Material
SD Sediment Diversion
SP Shoreline Protection
ST Sediment/Nutrient Trapping
VP Vegetative Plantings

Net Benefitted Acres include aquatic vegetation & enhanced wetlands

* Denotes benefits not varified by the Wetland Value Assessment Work Group.

** Total includes only Short-Term Critical and Short-Term Supportin Projects.

*** Total includes Short-Term Supporting, Short-Term Critical, and Long-Term Critical (20 year) Projects.

PROJECT DESCRIPTIONS

The following descriptions, for each of the projects which have been considered for the restoration of the Mississippi River Basin, are listed by category and described in as much detail as is available. The benefits of most of the projects described in this section were estimated according to a modified rapid-assessment Wetland Value Assessment (WVA) protocol. These assessments were based, in part, on project-specific information which varied in quantity and quality between projects. These estimates are therefore rough approximations, considered preliminary to a more in-depth assessment, and should be interpreted and used as such. Information for some projects, such as shoreline erosion and marsh creation projects, may be more accurate since these projects are quite site specific. Benefits for projects such as hydrologic restoration and marsh management are less accurate due to the generality of these projects.

Projects which have been included on the first three Priority Project Lists have undergone the complete in-depth WVA analysis. These projects have also received more rigorous and detailed construction and operation and maintenance cost estimates.

All cost estimates were developed using a standard formula which included construction cost plus 12.5 percent for planning, engineering and design; 11.5 percent for supervision and administration; and 25 percent for contingencies, plus monitoring and operations and maintenance for 20 years.

Table 5, located in the previous section, provides a summary of these projects, and Figure 5 designates their approximate locations.

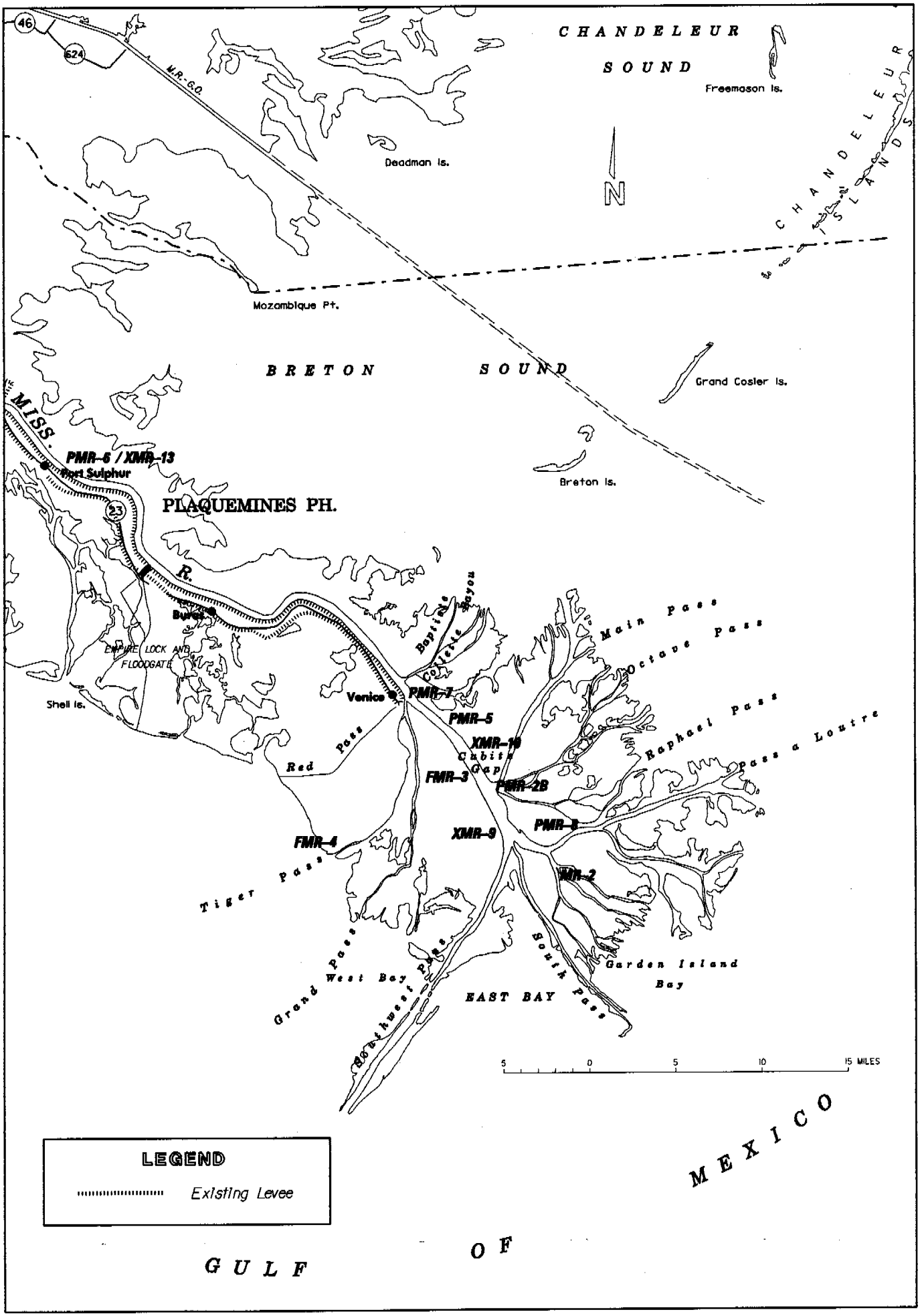


Figure 5. Mississippi River Delta Basin, Project Locations.

CRITICAL LONG-TERM PROJECTS

PMR-6 UNCONTROLLED DIVERSION OF THE MISSISSIPPI RIVER

Problems and Opportunities.

The key element or project of the selected plan is the large scale uncontrolled diversion of the Mississippi River. This diversion can be viewed as the embodiment of the alternative, although it is certainly not the only feature. The diversion of the flow and sediment from the Mississippi River could be accomplished by the construction of a new channel from the river to an adjacent estuary, where the sediment deposited would build emergent wetland more effectively than in the deep water at the river's mouth. This diversion channel would become the primary outlet for the flows of the Mississippi River, discharging an estimated 70 to 100 percent of the river's flow into the Gulf of Mexico. With such a diversion, deep-draft navigation would need to be maintained in the Mississippi River's present channel, where the industrial development requiring deep-draft access is located. The purpose of such a diversion would be to utilize the river's flow in order to distribute its sediment load to a shallow water estuary for creation of a new delta.

While this action is being termed a project for the purpose of inclusion in this plan, it is readily recognizable that significant study will be required prior to execution of any construction. It is also recognized that such a study will be a substantial undertaking and may require separate, or additional, funding and authority.

It is proposed, then, that this study, undertaken at a reconnaissance level by the U. S. Army Corps of Engineers, New Orleans District, in February 1990, be re-initiated at the feasibility stage in order to assess the benefits of the project to the entire Louisiana coast over a longer project life. It is clear that an action of this magnitude would have net benefits reaching far beyond a 50-year project life. The study also would need to view the project in contrast to long-term net losses for the entire Louisiana coast without a major action of this nature. Given the need to utilize this resource and the outcome of the previous study, a goal of an additional study would be to identify a point in time where immediate impacts are preferable to continuing losses. An important aspect of a study would also be to determine whether existing technology to restore these wetlands could be out-stripped prior to reaching a point where restoration becomes beneficial.

For the purpose of this description a conservative alternative which does not include navigation locks has been selected. With this alternative 30 percent of the total flow would be retained in the existing channel, as a result of maintaining the channel for navigation, unless some system of locks is employed. While alternatives utilizing a lock through navigation system are viable it should be note that both positive and negative impacts increase--in varying degrees--in these alternatives.

An extremely important impact of this project would also be the deterioration of the existing delta. This area represents a significant existing resource in terms of both habitat and wildlife and fisheries production. An estimation of the expected rate of its loss over time versus growth of a new delta is needed. With this estimate

a projection of the net wetland gain over time could be derived. This evaluation would also include effects in the diversion receiving area.

Description.

Available information gives an indication of what alternatives have been considered to this point. It also provides a conceptual picture of the project and a gross estimate of what benefits and impacts would be expected of the project over a 50-year life. It should be recognized that the true life, and resultant impacts and benefits, of a project of this magnitude could possibly extend an order of ten times longer. A number of potential diversion sites were considered in the previous study. Each of the sites investigated would provide sediment deposition in estuaries where large land areas would be created. Sites upstream of New Orleans were immediately eliminated. The cost of relocations associated with the diversion channel, the cost of salinity intrusion measures for the metropolitan area and downstream, and the effects on water quality of reduced flow in the river downstream of the diversion made these sites significantly less desirable than those downstream. Three sites downstream of New Orleans have been further evaluated. These included sites at Caernarvon and Bohemia on the east bank of the river and a site at Myrtle Grove on the west bank.

The diversion of flow and sediment from the Mississippi River would result in an increase in maintenance dredging requirements in the existing channel. This increase in maintenance dredging could be eliminated by constructing locks for navigating between the reaches of the river up and downstream of the diversion. Estimates have been developed of the net increase in maintenance dredging if the locks were not constructed. Locks and connecting channels have been preliminarily designed and costed. With locks, all of the river's flow and sediment would be diverted. Without locks a portion of the total flow and sediment would remain in the present channel. A comparative summary of costs and land created is shown in Table 6 below.

Table 6. Costs and Benefits for Various Uncontrolled Diversion Alternatives

Site	First Costs (Millions of Dollars)	O & M Costs	Net Land Areas (Acres)
Bohemia with Locks	793	0.4	127,300
Bohemia w/o Locks	102	15.6	89,300
Caernarvon with Locks	1,160	0.6	88,300
Caernarvon w/o Locks	490	15.5	80,300
Myrtle Grove with Locks	1,150	0.7	151,000
Myrtle Grove w/o Locks	455	12.9	116,000

These totals represent projections over a 50-year period. Net land areas would continue to increase beyond the project's 50-year economic life. As can be seen in the summary, the inclusion of locks results in a considerable increase in project cost regardless of the site. Barring the development of new technology in this area, it is not anticipated that the use of navigation locks would provide the optimum alternative.

The Caernarvon and Bohemia site plans each provide for the diversion of Mississippi River flow and sediment into the Breton Sound Basin to the east of the river. The Caernarvon plans, both with and without locks, cost more than the respective plans at Bohemia and would result in less net land as estimated over the 50-year economic life of the plans. In addition a diversion at the Bohemia site would result in a lesser degree of disruption to existing activities in the upper Breton Sound basin. The Caernarvon site also posed added complications because of the existing freshwater diversion structure at that site. The Caernarvon site was therefore eliminated from further consideration.

The Bohemia site versus the Myrtle Grove site, in addition to being less costly, provides a much larger area for delta development beyond that which is projected for the 50-year project life. In contrast, the enclosed bay system of the Barataria basin provides a limited, albeit more efficient, platform for the deposition of sediments and creation of wetlands. Because the Myrtle Grove site would provide diversion into an enclosed estuarine system, a greater level of development and land use activities would be impacted by a diversion at this site. The scheme proposed for the restoration of the Barataria basin, addressed in a separate volume of this document, employs diversion of river flows on a smaller, controlled basis to accomplish its goals with less disruption of existing activities. As a result the Bohemia site, shown on the strategy map, is presented, not as a final site, but certainly as the preferred one. The tentative location of the diversion would be in the vicinity of the Bohemia Spillway on the left descending bank of the Mississippi River at approximately river mile 40 above the head of passes (AHP). The pilot channel would extend from that point in an east-southeasterly direction into the shallow open water of Breton Sound.

Physical construction of the diversion under the current design would involve cutting a pilot channel with a bottom width of 300 feet at an invert elevation of -10.0 feet NGVD. The construction may also require stabilization efforts along the main river channel in order to secure the configuration of both the river and diversion channels at the point of diversion. Additional studies may show that an alternate channel configuration would be beneficial in controlling the rates of channel development and impact to the receiving area.

The diversion would be uncontrolled, with flows into the Breton Sound basin being determined by the available hydraulic differential. It is projected that the initial pilot channel would enlarge rapidly in the first 5 years after completion. It is estimated that, by the time the diversion channel reaches its final dimensions, an average of 70 percent of the Mississippi River's flow and sediment load would be diverted into Breton Sound. The remaining 30 percent of the total flow and sediment would continue to the gulf in the existing Mississippi River channel. As was noted above, controlling the rate of channel development and the resulting rate of capture could lessen the severity of the impacts in the receiving basin. This concept will be investigated in developing the project.

Benefits and Costs.

The projection of habitat 50 years in the future with the diversion in place shows a net gain in wetlands, attributable to this project by this analysis, of 89,300 acres of fresh-intermediate marsh. This estimate also assumes that currently brackish and saline marshes that would remain in the area 50 years in the future

without the project would be converted with the project in place. There are currently over 175,000 acres of brackish and saline marshes in the Breton Sound basin. While additional wetland losses will be incurred prior to the possible execution of this diversion project, a reasonable projection of fresh-intermediate marsh in place 50 years following project execution would be in excess of 200,000 acres.

The construction costs for this alternative, as outlined in the cited study and updated to current price levels, total $104.2 million. A significant portion of this total, an estimated $50 million, is dedicated to relocation of existing activities. Another $35 million of that total is directed toward the construction of a jetty along the west side of the Mississippi River Gulf Outlet to reduce shoaling in that channel that would result from sediment laden diversion flows. An estimated $7.0 million of the initial cost is for additional saltwater mitigation measures. Construction costs for the actual diversion and pilot channel are estimated at $10.9 million. The remainder of the project expense involves acquisition of real estate and easements. Operation and maintenance costs associated with this diversion include an estimated $11.7 million annually in increased dredging costs. In addition annual costs of $1.0 and $3.5 million for saltwater mitigation measures and maintenance of the MRGO jetty, respectively, are associated with the diversion. These estimated costs include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs.

Monitoring costs have not yet been established. At a minimum, a project of this type and size would be allocated a monitoring budget of roughly $26,000 per year under the CWPPRA monitoring criteria. Because of its magnitude, this effort will almost certainly require a greater level of funding. The monitoring effort for a project of this scale will also require the integration of existing, individually funded and administered, State and Federal monitoring programs.

Because of the high annualized costs associated with a diversion, the estimated cost is greatly affected by project life. While the majority of projects discussed in the basin plans are based on a 20-year project life, a project of this scale could not reasonably be undertaken with less than a 50-year project life. For the sake of consistency a 20-year estimated cost for a major diversion has been used to display the relation of this basin to other basins. Within the context of the Mississippi River Delta Basin, the 50-year estimated project cost of $910,000,000 will be used.

Effects and Issues.

The environmental effects of this diversion project were also addressed in the previously mentioned report. As analyzed in the cited report it has been projected that 89,300 acres of water bottom would be replaced by emergent delta 50 years in the future with the project in place. The character of the Breton Sound basin would experience a drastic change from a saline to a freshwater estuary. Along with this change an immediate decrease in water quality would be expected due to the massive influx of Mississippi River water. However, water quality is expected to improve as new wetlands are created and begin to filter these flows. The existing delta would experience a change from fresh and intermediate marsh types to brackish and saline types within 10 years of the initial freshwater diversion. Land-loss rates in the existing delta would also accelerate with the reduction of sediment laden flows. It is expected that with the deterioration of the existing delta the

sediments would be reworked and moved along the coast nourishing beaches and barrier islands to the west. It is also expected that barrier islands would ultimately develop in the area of the existing delta.

The tremendous salinity reduction in the Breton Sound basin will initially impact a majority of the estuarine biologic community complexes. It is estimated that 40 percent of the publicly leased oyster grounds in the state of Louisiana would be taken out of production as a result of this project. Although the rapid influx of fresh water into Breton Sound will dramatically change the nature of the sound, elimination of the estuarine system along with spawning and nursery areas for commercial fisheries is not anticipated. Spawning areas for many estuarine-dependent species are in marine environments and, thus, beyond the influence of the diversion. Additionally, spawning habitat is not limiting for these species. Estuarine nursery areas will be affected significantly; however, conditions should be enhanced for species such as gulf menhaden and white shrimp which utilize fresh to low salinity marshes as nursery areas. Species which require more saline nursery habitat will be displaced seaward. At some point beyond the project life, the area impacted by the project would once again be receptive to these marine communities. Ultimately, the overall extent of available nursery habitat may not change or may actually be increased or improved as a result of fresh water introduction.

It is projected that, with respect to currently proliferating species, the newly created wetlands may not be as productive as existing wetlands in the basin. The most productive areas for terrestrial wildlife in the existing delta are in and around the new wetlands created by natural and manmade crevasses. The wetlands created by a major diversion into Breton Sound should be of similar productivity. Additionally, the influx of nutrients, as a result of the diversion, should provide a powerful boost to overall productivity within Breton Sound. Organisms displaced from the Breton Sound basin may begin to re-establish in the area occupied by the current delta. Conversely, the species currently inhabiting the fresh marshes of the existing delta may also be displaced. The productivity of a new delta may be represented by a different species association than that found in the existing delta, but overall productivity should be at least as high, if not higher.

In the existing delta, the rapid decrease in freshwater flows through the area would result in some immediate impacts to existing vegetative types. With retention of 30 percent of the river's flow through the existing passes, some fresh marsh may be retained in this delta. However, as a result of the loss, or reduced area, of this habitat, much or all of the duck and goose population wintering in this area would be forced to utilize other areas of freshwater habitat in coastal Louisiana. Likewise the alligator and fur bearing populations of the existing delta would be compressed if not eliminated as a result of the diversion.

Key issues involve legal and real estate aspects of the project. The disposition of the extensive oyster leases administered by the State of Louisiana is of major concern. The acquisition of real estate and easements for projects involving sediment diversion into wetlands and open water areas has resulted in legal and real estate questions in the past as has the ownership of lands created by naturally deposited sediment.

Another group of issues facing this project centers on the environmental effects of diverting fresh water into a predominantly saline system. A number of these

issues have been touched upon previously. In particular the short-term impacts to commercial fisheries in the Breton Sound are extreme. The value of this harvest has been estimated to be as much as $9.3 million a year. The displacement of components of this fishery could result in the loss of employment in the fishing based communities. Conversely an increase in the productivity of certain species may present additional opportunities for commercial expansion. These losses would also extend to fleet, processing capital equipment, and property and tax values in these areas. Communities along the lower river downstream of the diversion would also experience impacts to their water supplies as would industries in this area. Indirect impacts would occur in the form of added dredging costs to support deep-draft navigation.

On the reverse side of the shift from one type estuarine system to another, the induced deterioration of the existing delta is a major concern. The heavy concentration of refuge wetlands located on the east side of the main river channel makes the managed retreat of this area imperative. Some quantification of the immediate impacts to vegetation in the delta will be a necessary output of any additional studies. Some analysis of the distribution of available freshwater volume throughout the existing delta, after diversion of the river, will also be necessary.

A sub issue involving the effects in the Breton Sound estuary touches upon prior legislative action. Portions of the Chandeleur Islands are protected as National Wilderness Areas, and as such any manmade alteration of the physical state is forbidden. These refuges areas, under the administration of the U.S. Fish and Wildlife Service, also support a number of protected species of birds. Any possible effects to the ecosystems of these islands must be determined and then be resolved with the protecting legislation.

Status.

As of this point in time the concept for this alternative has been investigated at a reconnaissance level. The "Louisiana Coastal Area, Mississippi River Delta Study" was completed by the U. S. Army Corps of Engineers, New Orleans District, in February 1990. This report investigated multiple options for diversion of the river and provides the most detailed analyses currently available. However, the conclusions in the report were developed based on traditional economic (cost to benefit) criteria over a 50-year project life. This analysis resulted in a negative recommendation to proceed with project feasibility studies, due primarily to the immediate economic impacts to commercial fisheries.

CRITICAL SHORT-TERM PROJECTS

FMR-3 WEST BAY SEDIMENT DIVERSION.

Location.

This project is located in Plaquemines Parish Louisiana approximately six miles south of the city of Venice. The diversion site will be located on the right descending bank of the Mississippi River within the existing delta 4.7 miles above Head of Passes. The project site consists of 12,910 acres of primarily shallow open water.

Problems and Opportunities.

This type of project will be a major tool in any maintenance or restoration effort in the Mississippi River delta. The current lack of significant fluvial overflow from the Mississippi River has been indicated as a primary cause for the accelerating deterioration of Louisiana's coastal wetlands. Diversion projects provide a means of reestablishing these lost processes. Uncontrolled diversion projects of this size mimic a natural process on the scale of a river crevasse during a flood event or, in the venue of the delta, the opening of a new pass.

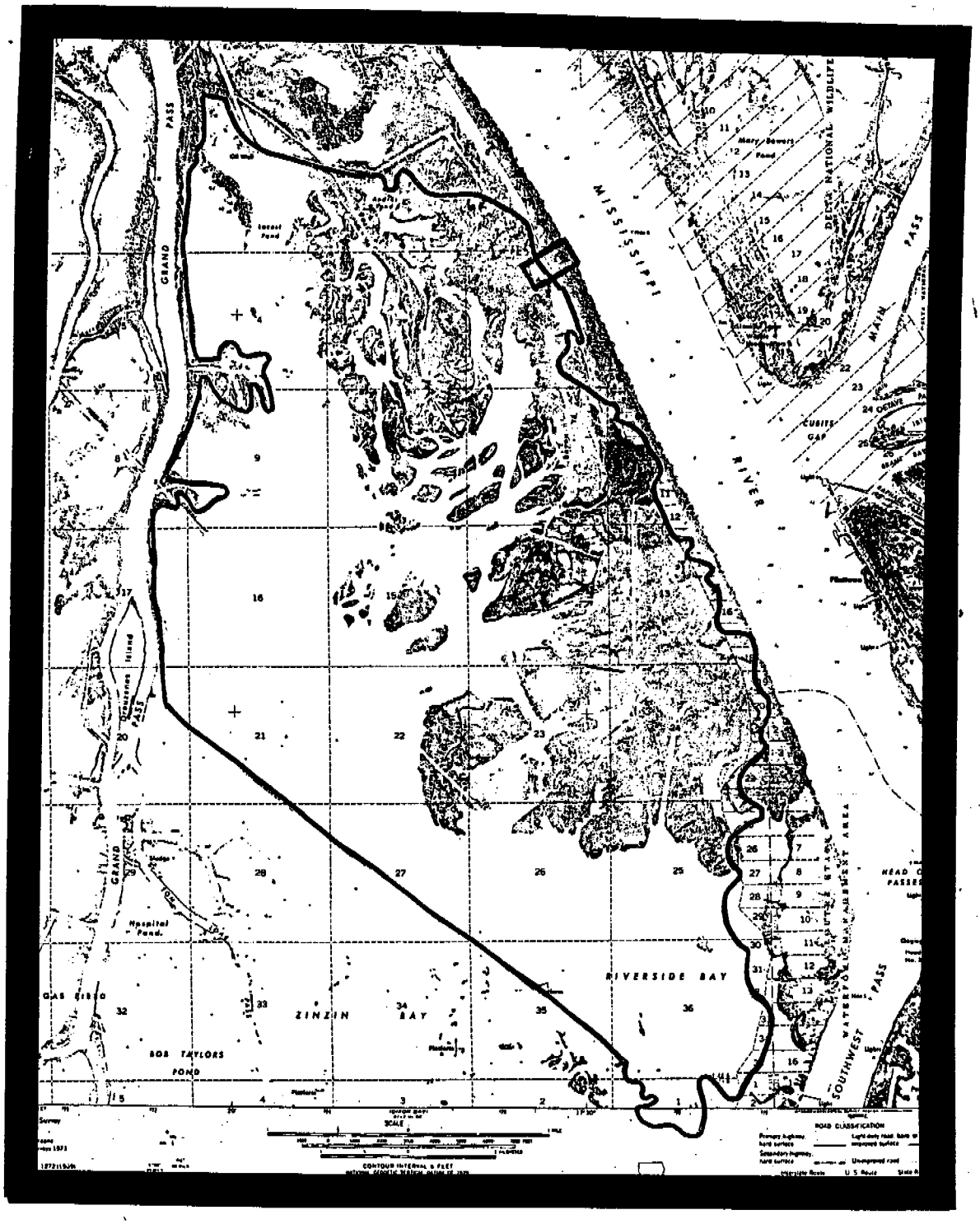
Small scale diversions or crevasses are presently in wide use within the delta and have been a primary tool for mitigation of both oil and gas, and federal navigation and flood control activities. These small-scale projects have proven to be very successful. Over a long period of time, repetitive use of these projects may be common. With this in mind it is clear that, regardless of the ultimate approach taken for utilization of the Mississippi River, these sediment diversion projects must be actively pursued.

Description.

The project consists of the construction of an earthen broad crested weir and conveyance channel. The initial construction will be based on a diversion of 20,000 cubic feet per second (cfs). After an operational trial period accompanied by intensive monitoring, the diversion cross-section will be enlarged to accommodate a design flow of 50,000 cfs. The project will also involve the relocation of 1,500 feet of a 10-inch diameter crude oil pipeline.

The initial diversion cut will be dredged to an invert depth of -45.0 feet NGVD. The channel cross-section will be controlled by a 30 foot bottom width rising on 1 on 3 side slopes. Construction of the initial diversion will require the removal of 650,000 cubic yards of material by hydraulic dredging. The final phase construction will require dredging an additional 1,450,000 cubic yards of material. The dredged material will be placed at an elevation of 4.0 to 4.5 feet NGVD and used to create additional wetland area. To enhance sediment retention in the receiving area, sediment retention dikes will be constructed in these shallow open water areas. To ensure the performance of the diversion cut, the outfall channel and the bifurcations, which will eventually develop, will be dredged to maintain their capacity.

The project is a scaled uncontrolled diversion and as such relies on hydraulic differential to control the volume of flow through the channel cut. The scaling of the channel cross-section was based on achieving a desired design flow with the



West Bay Sediment Diversion FMR-3

Figure 6

occurrence of the 50 percent duration stages on the river and receiving sides of the diversion. The initial diversion will be operated through one or two high water seasons and monitored to assess the magnitude of its effects in relation to the river channel. After this period of monitoring, barring any extreme adverse effects, the diversion will be enlarged to its full operational capacity.

Benefits and Costs

The project is expected to create 9,830 acres of fresh-intermediate marsh over a 20-year project life along with benefitting an additional 890 acres. Using the environmental assessment methodology employed for CWPPRA projects, this translates to an annual average of 4,912 habitat units. Total estimated construction cost for both phases of the project is $2,644,000. These estimated costs include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Other costs associated with the project include operation and maintenance, $35,509 per year, and project monitoring, $54,298 per year. The resulting total estimated cost for a 20-year project is $6,328,000.

Induced costs as a result of this project were also estimated but are considered project costs. These costs amount to 13.2 million in present worth dollars over a 20-year life total. These costs include impacts to water supplies, induced dredging and emergency closure contingencies.

Effects and Issues.

This project will have a major effect on the ability of any agency or organization to implement projects of this type and magnitude in the future with regard to the issues noted later in this section. However, once implemented this project and others like it will have the effect of restoring not only wetlands but also natural fluvial processes that have been all but lost in this century. The project itself will reclaim some 9,800 acres of shallow open water bottom and maintain its productivity for many years beyond its design life.

As noted in the project costs the project will result in additional dredging in order to maintain deep-draft navigation in the Mississippi River. Impacts to existing water supplies are also anticipated. There are an estimated 277,000 linear feet of canals and slips in the project area which will require maintenance dredging if they are to remain open with the project in place. The diversion receiving area is presently a freshwater estuary; therefore no adverse impacts to commercial fisheries are anticipated.

Major issues facing the execution of this project involve real estate disposition and the acquisition of real estate rights. Nearly 100 percent of the diversion receiving area was at one time emergent wetland which has deteriorated into shallow open water bottoms. The entire project area, therefore, is or was at one time subject to private ownership. In addition separate ownerships or leases of mineral rights exist on the majority of these tracts. A second real estate issue involves the disposition of created wetlands in relation to their long-term conservation. This issue revolves around the limitation of land uses within the project area and the length of time, following construction, that these uses would be restricted. This would of course be compounded if the final disposition of ownership of newly created wetlands cannot be resolved.

An item of concern, which would only come into play after completion of the project, is the emergency closure of the diversion. The need for this closure could come as a result of one of two scenarios. One would be if the diversion cut or channel should begin to rapidly enlarge and capture more than the projected flow for the existing phase. The second, and of more concern would be if deposition in the navigation channel increased to the point that navigation could not be maintained. This scenario could occur during the high flows experienced near the peak of a flood event making it difficult to effect a closure.

Perhaps more significant than these issues themselves, is the ultimate manner in which they are resolved. This project represents a prototype model for future diversions of the Mississippi River, controlled as well as uncontrolled. The positions taken, in relation to the effects of the project on other activities, and the means for dealing with these issues will directly impact whether larger scale, longer term projects can and will be executed.

Status.

This project involves the largest pseudo uncontrolled diversion of the Mississippi River to date. It is an approved project from the first priority project list of the Coastal Wetlands Planning, Protection and Restoration Act. The only control of the diversion is represented by the maintenance of a specific cross-sectional area. Additionally the range of the hydraulic differential across this diversion is limited due to its proximity to the Gulf of Mexico. However, this project, aside from these two items, is viewed as a prototype model study for any other major diversion of the Mississippi River. In this regard, this project is critical to many future CWPPRA efforts.

The project is currently in design phase. Limited model testing is being done to verify the magnitude of its effects on the existing navigation project and the ship anchorage adjacent to the diversion site. These tests should establish the level of increased maintenance accountable to the diversion project. The identification of future dredging needs and the availability of, or need for, additional capacity to address them is critical to the executability of the project.

SUPPORTING SHORT-TERM PROJECTS

MR-2 PASS A LOUTRE SEDIMENT FENCING

Location.

The Pas a Loutre sediment Fencing project is located in the Mississippi River Delta in Plaquemines Parish, Louisiana approximately 11 miles southeast of the city of Venice. The project consists of six areas comprising 2,250 acres of shallow open water bottoms. All six of the proposed sites for the project are located on the Pass a Loutre Wildlife Management Area which is roughly defined by South Pass, Pass a Loutre, and the Gulf of Mexico.

Problems and Opportunities.

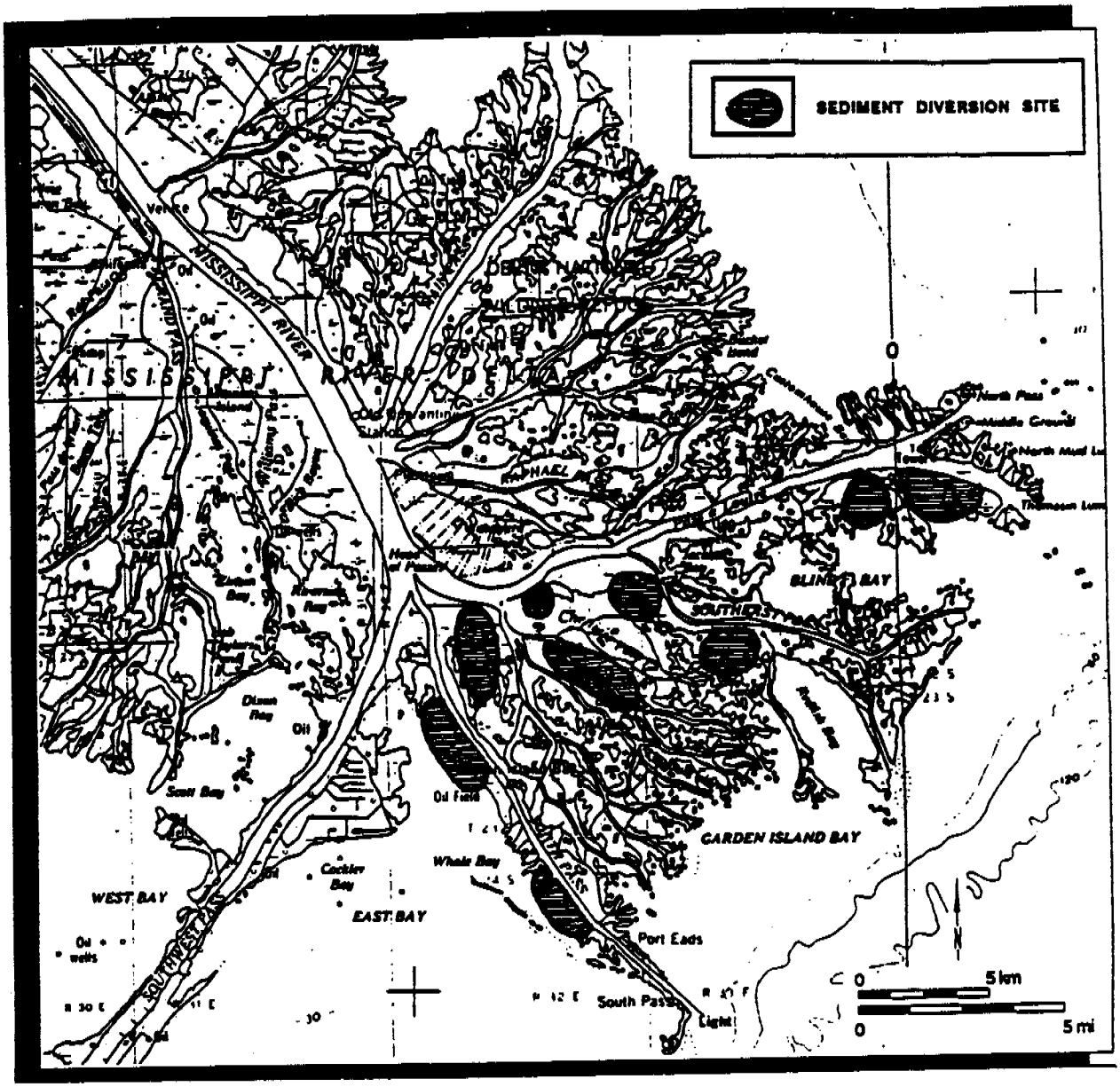
The Pass a Loutre fencing project was developed in conjunction with the Louisiana Department of Wildlife and Fisheries (LDWF) as a result of their past experience with this technique. LDWF has used sediment fencing at a number of sites on the Pass a Loutre Wildlife Management Area. Sediment fencing is another type of project which can be readily developed and executed for any shallow open water site. These projects can be developed in conjunction with a small scale diversion or crevasse project. The sediment fencing technique is useful for optimizing retention of suspended sediments where regular overflows occur. It is anticipated that a number of these projects may be undertaken in the Mississippi River delta, although in all likelihood any additional projects would be smaller in scope than the Pass a Loutre fencing project. The availability of sites in the Mississippi River delta is high and should continue to be so in the future regardless of the alternative pursued in this basin.

Description.

A sediment fence unit consists of two parallel fences 100 feet in length, spaced 3 feet apart. These fence units are constructed in a V pattern with the point of the V located against the apparent flow at the site. The fences themselves consist of 4 by 4 inch posts 12 feet in length, driven into the substrate to a depth of 9 feet and spaced at 10 foot intervals. The top 3 feet of these posts are strung with a 2 by 4 inch mesh weld wire. These fences can be constructed in any shallow open water area where the normal depth ranges from 1 to 3 feet. Regular overflow of the area due to natural or manmade channels is also desirable.

Fence units may be constructed in rows, end to end, with a minimum spacing of 15 feet between units. Multiple rows of fence units are often constructed perpendicular to the direction of flow. Rows are usually spaced a minimum of 1,000 feet apart. The Pass a Loutre Sediment Fencing project involves construction of 75,000 linear feet of fencing units at six separate sites. At each site this pattern of multiple rows will be used to achieve a saturation of the open water area available.

These structures are essentially uncontrolled in their operation. As the ambient flow at the site encounters the fence structure, velocities are reduced in the shadow of the structure allowing fine suspended sediments to deposit. This results in the formation of a small delta splay. The wire mesh portion of the fences generally require replacement somewhere around the midpoint of the 20-year life span. In addition to the replacement of the wire mesh, the supporting post may be raised



Pass a Loutre Sediment Fencing MR-2

Figure 7

after some deposition has taken place in order to take advantage of greater depths of overflow.

Benefits and Costs.

The projections of benefits are based on experience from prior sediment fencing projects. This experience has shown that each sediment fencing unit will produce one half acre of emergent marsh and enhance submerged aquatic vegetation over an additional one quarter acre. These benefits usually take only a 5 year period to develop and can be compounded over time by expanding the pattern of structures to fit an area.

The Pass a Loutre fencing project will create an estimated 320 acres of marsh in the initial 5 years of the the project along with 188 acres of enhanced aquatic vegetation. By saturating the selected sites with structures the project will encourage the complete filling of each of the sites. As a result the WVA projects that the overall project will create 1,500 acres of emergent marsh over a 20-year life span. In addition 320 acres of aquatic vegetation should be enhanced.

The cost of a fence unit can vary from approximately $14 to $21 per foot. The mobilization and demobilization cost of equipment and manpower for construction of the Pass a Loutre structures is estimated at $50,000. This amount may not vary substantially for smaller scope projects. This is due to normally remote locations and the labor intensive nature of the construction effort. As a result of the mobilization/demobilization costs, unit cost per foot of structure may vary considerably with the total length of structure involved in a project. A potential area of savings which should be explored for these projects is the use of alternate or recycled building materials.

The estimated first cost of the Pass a Loutre fencing project is $1,891,000. The basic cost is for the construction of 75,000 feet of sediment fencing structure at $14 per foot. This estimated costs include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Maintenance costs of $688,000 are based on partial replacement of structures ten years into the project life. Monitoring cost for this type project have been estimated at $4,325 per year under the CWPPRA monitoring criteria. The total estimated cost for this project is $2,666,000.

Effects and Issues.

This technique enhances the capture of naturally available flow and sediment resources in areas where they are already present. Under normal conditions these areas are unable to retain these available resources due to the magnitude of prevalent natural forces.

Some concern exists over the effect of this technique in combination with small scale diversions. The concern is that the accelerated deposition in the receiving area will reduce the effectiveness and longevity of the diversion. At this time this effect as not been verified. In relation to this concern, the observed effects of fence patterns on the development of channels through an area will be an important output of the Pass a Loutre project.

Status.

The Pass a Loutre fencing project was analyzed and reviewed as a candidate for the PPL2 of the CWPPRA, however it was not included on the final list. The project has undergone engineering and environmental analyses to determine cost effectiveness. Subsequent to this review it was determined that the Louisiana Department of Wildlife and Fisheries was able to execute portions of this project through an alternate funding source. At this time it is estimated that approximately 50 percent of the fence structures outlined in this project have been undertaken. As a result pursuit of this project has been dropped. Additional sites suitable for this type of project will be investigated for future use.

FMR-4 TIGER PASS DREDGED MATERIAL DISPOSAL

Location.

The project is located in Plaquemines Parish on 595 acres adjacent to a 2.1 mile channel reach at the mouth of Tiger Pass. Tiger Pass is one of three passes which bifurcate from a break in the west bank of the Mississippi River known as "The Jump" located at Venice, Louisiana. This break supplies the northernmost passes on the west side of the river. The mouth of Tiger Pass is approximately 14 miles downstream from The Jump.

Problems and Opportunities.

The project area is subject to highly advanced wetland deterioration. Tiger Pass is an authorized federal navigation project subject to regular maintenance dredging at a 2.5 to 3 year interval. The normal disposal of maintenance dredged material would involve confinement dikes and placement of material up to an elevation not conducive to marsh creation. An opportunity is presented in this situation to beneficially use this regularly dredged material to establish new wetlands.

Description.

The project would consist of the placement of approximately 1.1 million cubic yards of dredged material in an unconfined area to an elevation of 4.0 feet NGVD. This material would ultimately subside to an elevation of 1.5 to 2.5 feet NGVD. The maintenance dredging of this quantity occurs on a 2.5 to 3 year cycle. The placement of the material for each cycle would be adjacent to the wetland area developed from the previous dredging cycle. This procedure would be followed over the 20-year life of the project resulting in the beneficial placement of seven dredging cycles.

Benefits and Costs.

The WVA analysis has indicated that this project would initially establish approximately 85 acres of land at elevation 4.0 feet NGVD and 120 acres at elevation 0.0 feet NGVD with each dredging cycle. Over the 20-year life of the project some 415 acres of new emergent wetland are expected to be created. In addition approximately 45 acres of aquatic vegetation is expected to be enhanced by the project over its life.

The cost of each maintenance dredging cycle has been estimated at $670,000 and this represents the estimated cost of the project. This estimated cost includes 25% contingencies as well as 5.5% Engineering and Design cost and 7.5% Supervision and Administration costs. Repetition of this cost for six additional dredging cycles at 2.5 to 3 year intervals is projected as a maintenance cost of the project. Monitoring cost for this type project have been estimated at $4,325 per year under the CWPPRA monitoring criteria. The cost estimated for a 20-year project is $4,434,000.

Effects and Issues.

This project would accomplish the important goal of using dredged sediments beneficially. Given the large volume of sediments dredged as a result of regular channel maintenance within coastal Louisiana putting this material to beneficial use is a significant positive step.

Tiger Pass Dredged Material Disposal FMR-4

Figure 8

An issue in accomplishing this goal will be the distribution of additional cost incurred as a result of placing dredged material in appropriate locations. At issue is whether this cost should be bourn completely by the designated maintaining authority or shared with the local sponsoring entity benefitting from the modified placement.

Status.

This project was included in the 1st Priority Project List with a deferred status. The project was reanalyzed and considered for the 2nd Priority Project List but was not selected. Engineering and environmental analyses for comparative rating of the project have been completed and reviewed. This project could be readily advanced to the engineering and design of plans and specifications and may be considered for inclusion on a future priority list.

PMR-5 BENNEYS BAY (EAST BAY) SEDIMENT DIVERSION

Location.

The proposed project site is located on the left descending bank of the Mississippi River at river mile 7.5 AHP. An alternate diversion site could be located 4 miles downstream of this site. This alternate site is located on the north bank of Main Pass roughly 2,000 to 3,000 feet downstream of Cubit's Gap which is located in the left descending bank of the Mississippi River at mile 3.0 AHP. Either one of these channel locations is capable of serving the 16,300 acre receiving area which is loosely bounded by Baptiste Collette to the north, the Mississippi River to the east and Main Pass to the south. Other than the tracts located immediately adjacent to the main river channel this area falls entirely within the Delta National Wildlife Refuge.

Problems and Opportunities.

The problems and opportunities regarding this project are documented in the short term critical project West Bay Sediment Diversion, FMR3. Opportunities with respect to the restoration of natural building processes and use of available resources are also discussed in the descriptions of the small scale diversion projects.

Description.

The project consists of an earthen broad crested weir and outflow channel. The design is similar to that employed by the West Bay project. This project also has a design flow averaging 50,000 cfs. However, an available alternate design flow averaging 20,000 cfs may be suitable, following further analysis. This is due to the difference in configuration of the receiving areas of the sister projects. As currently outlined in the pending feasibility report the 50,000 cfs cut would require a 10 foot bottom width at elevation -47.0 NGVD with channel side slopes of 1 vertical on 7 horizontal. The 20,000 cfs diversion cut would require a 195 foot bottom width at elevation -25.0 NGVD with 1 vertical on 5 horizontal channel side slopes.

An available option which could be exercised would be the location of the channel cut on Main Pass as opposed to the main river channel. This option would lean toward the 20,000 cfs design and could be used if it proves to provide a lesser impact to maintenance of navigation. This option has the potential to overlap with another proposal for a small scale diversion at the same site which, if constructed prior to approval of this project, could simply be enlarged.

This project, like the West Bay project, would be an uncontrolled diversion. The volume of flow through the diversion is controlled by the channel cross-section and the available hydraulic differential across the cut. This differential is driven primarily by the river stage, however both lunar and wind driven tides can be a controlling factor, particularly during periods of low water in the river. In the vast majority of situations the river stage will be the positive influence on the diversion flow. The project will also include provisions for emergency closure of the diversion cut. This contingency is provided to avoid the possible capture of the river channel or the stoppage of navigation.

Benefits and Costs.

The benefits generated by this project would include created and enhanced wetlands as of this time these values have not undergone screening via the WVA

format. Benefits would be indirectly enhanced by virtue of their location in an area whose management is dedicated for the benefit of wildlife and fisheries. The total acreage created by the 50,000 cfs project is projected to be 10,760 acres and protect an additional 1,365 acres over a 20-year life. The 20,000 cfs project would create a projected 3,350 acres over a 20-year life. In addition approximately 1,350 acres of existing wetlands would benefit from an increased delivery of suspended sediments through the diverted flow. At this time the total acreage which would incur this benefit has not been quantified.

Costs for the Benneys Bay project should parallel those for the West Bay project. The current estimated cost for the full 50,000 cfs project is $2,644,000 including 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Current estimates of first cost for the 20,000 cfs project are roughly one half this amount. Other costs associated with the project include operation and maintenance, $35,509 per year, and project monitoring, $54,298 per year. The total estimated cost for this project is $6,328,000.

Total costs due to induced impacts to other activities, although not considered project costs, are estimated to be $13 million for the larger project. This is valued in present day dollars for a 20-year project life. While this cost would certainly be less for the smaller diversion it can not be assumed that the difference in total costs would be proportional to the differences of the first costs. Key among these costs is that of additional induced maintenance dredging. This project may also require the execution of a hydraulic model to quantify induced impacts to navigation, maintenance and water supplies. The estimated cost of this modeling is $225,000.

Effects and Issues.

The primary effect of the project would be the gradual accretion of 3,300 to 7,400 acres, dependent on the cut size, of marsh in shallow open water over the 20-year life of the project. The construction of the diversion cut and channel would eliminate a small area of existing wetland, a portion of which would be replaced with the beneficial placement of the excavated material.

The project would result in the relocation of several hundred feet of a 10-inch diameter crude oil pipeline. A similar length of aerial power and telephone lines would also require relocation. Other effects to the receiving area are primarily associated with deposition of suspended sediments. Since the receiving area is located on a federal refuge, activities there are limited and controlled. There are a substantial number of access canals in the area, the continued maintenance and use of which would be subject to the prior agreements and control of the refuge administrator, the U.S. Fish and Wildlife Service. This is in addition to the standard federal and state oversight of wetlands.

The issues concerning the Benneys Bay project parallel those surrounding the West Bay project. An exception to this would be the acquisition and final disposition of real estate. Because of the federal ownership of the majority of the land in the project area, real estate should not be a major issue. The primary issues for the eastern diversion will be the relocation of existing activities as mentioned above and the induced impacts to the main river channel. Foremost of the induced impacts would be the level of increased maintenance dredging and the subsequent effects on the ability to maintain uninterrupted navigation. This concern would be compounded with the assumption that the West Bay Diversion would be completed

and operating. Additional design analysis and post construction monitoring will likely be an issue in the ultimate execution of this project as a result. Finally the potential of the diversion capturing the river channel will require the design of a contingency plan and funding for closure of the diversion. It is hoped that the swift implementation of the West Bay diversion will provide valuable data for incorporation in the design of its sister project and perhaps some insight into the validity of these concerns.

Status.

This project is a sister project to the West Bay Sediment Diversion project approved in the 1st Priority Project List under the CWPPRA. This project is also addressed in the Land Loss and Marsh Creation Feasibility Report being completed by the U.S. Army Corps of Engineers, New Orleans District. This project has the potential to support either alternative outlined for this basin. It is viewed as a primary feature for sustaining or building of wetlands on the eastern side of the Mississippi River delta. With the submission of the 3rd Priority Project List the Channel Armor Gap project will eliminate a 2,100 acre portion of the project area. It is not felt that this will impact the viability of the larger project.

The status of this project is relatively advanced and documented in the Land Loss and Marsh Creation Feasibility Report sited previously. Some variations of the current design may be required in order to aid in the executability of the project. While background and design data are available in the mentioned feasibility study, it is anticipated that execution of this project will be contingent upon the completion and performance of the West Bay project. Barring this source of prototype data, the Benneys Bay project may be subjected to more stringent engineering evaluation than its sister project. The project is at a stage where assessment of environmental benefits could be undertaken.

PMR-8 PASS A LOUTRE SEDIMENT MINING

Location.

The site of this project is located in the Mississippi River delta on the east bank of the river channel approximately 10 miles south of Venice, Louisiana. The project falls within an area bounded by Raphael Pass, the main river channel and Pass a Loutre. From a real estate view point the project area is characterized by alternating federally and privately owned tracts. The federally owned tracts are designated as a portion of the Delta National Wildlife Refuge and administered by the U.S. Fish and Wildlife Service. The project site consists of 650 acres of shallow open water bottom.

Problems and Opportunities.

This project was selected for the 2nd Priority Project List of the CWPPRA and given a deferred status (see project status, below). The project involves the dedicated dredging of sediment from an area in and adjacent to the Pass a Loutre hopper dredge disposal area. The project utilizes material removed from the main river channel as well as the naturally deposited sediments in the pass. Because of the dredge disposal at this borrow site the sediment source is more readily renewable. The material removed from the pass will be pumped into shallow open water bottoms to an elevation suitable for the establishment and growth of marsh vegetation.

Description.

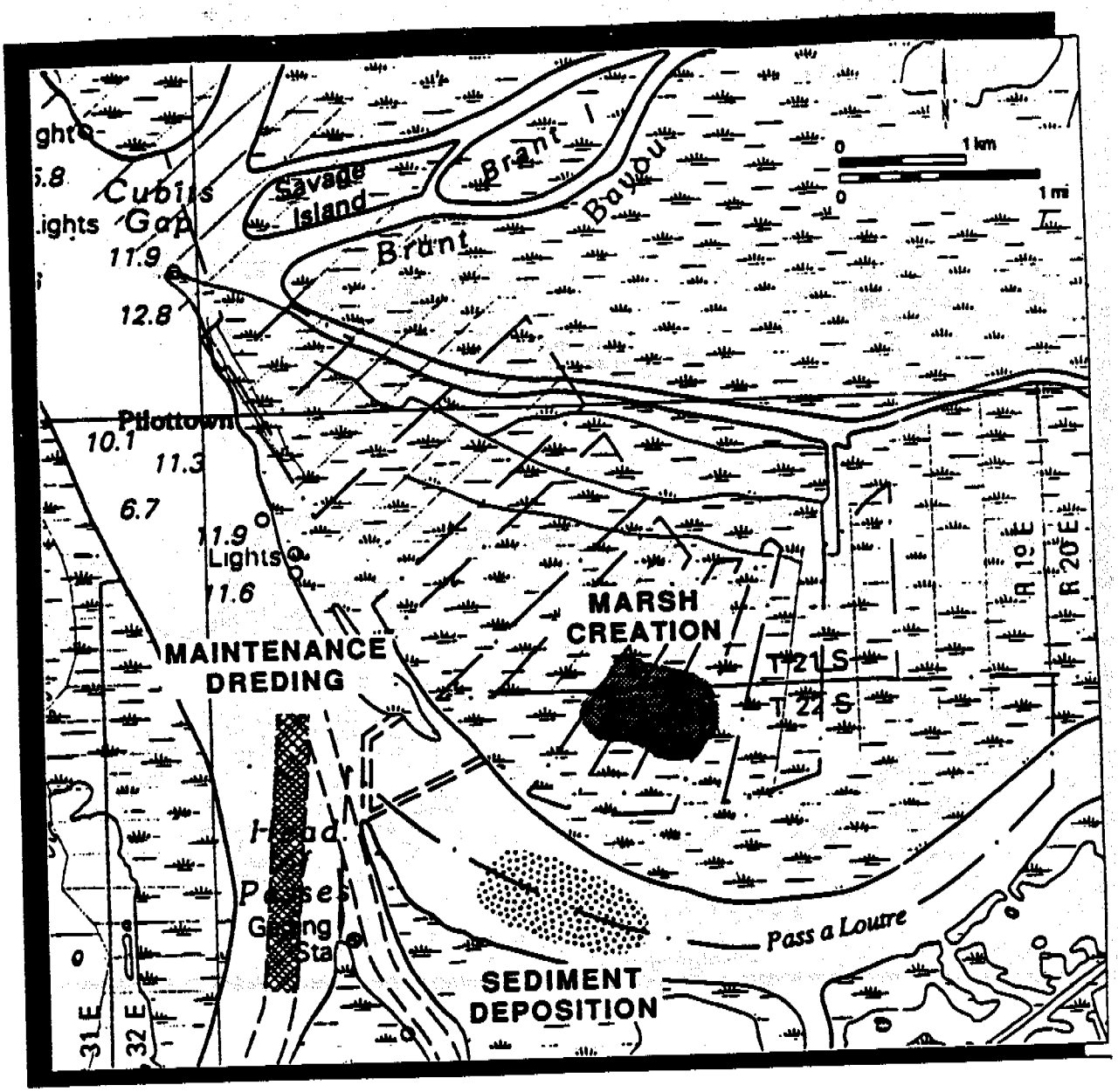
Approximately 800,000 cubic yards of material will be removed from Pass a Loutre by hydraulic dredge. The material will be pumped to a shallow open water area approximately 7,300 feet north of the pass. The material will be placed to an elevation not to exceed 2.5 feet NGVD. It is projected that this will result in the creation of 200 acres of emergent fresh marsh. In addition some 450 acres of water bottom adjacent to this newly created marsh will experience some degree of deposition which should enhance growth of aquatic vegetation.

This project entails a one time placement of dredged material. The benefits associated with this action are projected over a 20-year project life. However, at this time two delta splays have already been constructed from Raphael Pass into the vicinity of the project area. It is anticipated that flows and sediments from these cuts would enhance this one time placement of material over time. Because of the mutually beneficial nature of these projects other small scale diversions into this area are being considered.

Benefits and Costs.

The project will create 200 acres of fresh marsh, and enhance 134 acres over the remainder of the project area, immediately following construction. It is estimated that the acreage of emergent marsh would average 118 acres over the 20-year project life. The change in the enhanced area over the project life should be minimal.

The total estimated cost of this project is estimated at $1,160,500. Monitoring costs for this type project have been estimated at $4,325 per year under the CWPPRA monitoring criteria resulting in a total estimated cost of $1,247,000 over 20 years. No operation or maintenance costs are associated with this project. The estimated costs include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs.



Pass a Loutre Sediment Mining PMR-8

Figure 9

Actual unit construction costs were shown to vary significantly based on total volume of borrow, pumping distance and number of borrow sites required. The final design and costs represent an optimization of these parameters.

Effects and Issues.

This project capitalizes on an under utilized resource to convert open water to emergent marsh. This is a technique for marsh creation which must see broader use in the future.

The largest question posed as a result of this project, again, involves real estate. The key concern is the question of final disposition of ownership of created lands. In this instance public monies will be expended to create emergent wetlands on both publicly and privately owned real estate. The ownership and the restriction of surface uses for the conservation of these newly created wetlands are a principal concern for all parties involved in the execution of this, and any subsequent projects.

Status.

This project has been analyzed for engineering cost and environmental output within the CWPPRA screening process. The project was selected and approved for inclusion on the 2nd CWPPRA Priority Project List. Within the 2nd PPL this project received a deferred status. This indicates that the project may be constructed if an approved project on this list cannot be completed but does not guarantee its construction. During the consideration of the 3rd CWPPRA Priority Project List it was found that the original goal of this project could be met as a secondary benefit of the construction of the Pass a Loutre Crevasse project. As a result an alternative site will be located for this project within the boundaries described above.

SMALL SCALE SEDIMENT DIVERSIONS / CREVASSES

Location.

Primarily this section will provide a generic description of projects of this type, however, two specific sites will also be discussed. Some existing projects will run the course of their useful life spans and begin to regress and some existing marshes will begin to deteriorate. These crevasse projects will remain a standard tool for utilizing the available suspended sediment resources and reclaiming these areas.

Problems and Opportunities.

This type of project will be a major tool in any maintenance or restoration effort in the Mississippi River delta. Small scale diversions or crevasses are presently in wide use within the delta and have been a primary tool for mitigation of both oil and gas, and federal navigation and flood control activities. In fact so many of these projects exist, or are pending construction, that there is currently a scarcity of available sites. These small scale projects are believed to have a useful life span of 10 to 20 years. The largest of these diversions, measured in terms of one percent of the average river flow, may be productive for a longer period. The oldest of these small diversions is now 20 years old and is still showing some productivity. Once a site can be identified these projects can be readily developed and executed in a relatively short time frame. Over a long period of time, repetitive use of these projects and sites should be common. With this in mind it is clear that, regardless of the ultimate approach taken for utilization of the Mississippi River, these small scale projects must be actively pursued.

Description

Crevasses are essentially small scale uncontrolled diversions and as such require no operation. The volume of flow through the cut is controlled by the channel cross-section and the available hydraulic differential across the cut. This differential is driven primarily by the river stage. However, during periods of low water in the river, both lunar and wind driven tides can be a controlling factor.

These projects generally consist of a simple channel cut through an existing bank. The channel dimensions of these crevasses vary, with bottom widths of 50 to 300 feet and channel lengths of up to 1,500 feet. The depth of the channel invert is often governed by the minimum flotation requirements of the physical plant used to excavate the cut, generally 6 to 8 feet. The larger crevasses may exceed this, with depths ranging from 8 to 15 feet. Placement of the excavated material is also dependent on the equipment used for construction. A barge mounted dragline will stack the material adjacent to the cut while a hydraulic dredge may pump the material into the receiving area of the crevasse or spray the material more evenly adjacent to the cut. Each of these methods provides a varying level of immediate wetland creation.

The effects of these projects generally are minimal due to their size relative to the source of flow. Initially there is some slight loss of existing habitat with construction of the channel cut. Some of this loss is recouped in the placement of the excavated material in a beneficial manner. After completion of a crevasse the effects on the receiving area extend over a 5 to 10 year period, or longer in the case of larger diversions. During this period gradual deposition will convert shallow open water bottoms into emergent marsh.

Benefits and Costs.

The values outlined here are generic in nature. Since they are not detailing a specific project they have not undergone any level of detailed review. The acreage projected to be created by these projects also varies with size and volume of flow diverted. The smallest cuts may produce 20 or more acres in their life span while larger crevasses may produce up to 800 acres over a 20-year life.

The estimated costs for construction of these diversions will vary with their size. Another significant factor in their cost is that of mobilizing and demobilizing the necessary construction equipment. When a number of these cuts can be constructed under a single contract this cost to each project is greatly reduced. Costs for a very small crevasse may be $10,000 to $15,000 and can range up to $115,000 for a moderate cut of approximately 10 by 100 feet, 600 feet in length. For the largest of these projects costs may range as high as $450,000 to $500,000.

Monitoring costs for this type project have been estimated at $8,625 per year under the CWPPRA monitoring criteria. These projects typically do not have maintenance associated with them.

Effects and Issues.

Small scale crevasse projects are presently one of most effective and readily implementable tools available for the creation of emergent marsh. They are models of the effectiveness of natural fluvial processes as distributors of flow and sediment resources. This technique provides efficient creation of wetlands at low cost. One drawback associated with the placement of these projects is that increased water levels will be a result of duplicating a natural process.

The majority of the existing projects of this type have been constructed on publicly owned refuge lands. Because of this, no major issues have been raised to this point. Construction of these type projects on privately owned lands would, of course, raise the question of ownership and surface use restriction.

Status.

The status of crevasse projects which might be reviewed under this authority is preliminary in nature. Available reports, completed under other authorities, outline general design details of these type projects. Because the design of these projects is very general, they have the potential to be developed quickly. The principal requirement in developing these projects, in this basin, is the selection and definition of the site and the development of the real estate needs.

PMR-8/9A PASS A LOUTRE CREVASSE

Location.

The crevasse cut will be located near the head of Pass a Loutre on its north side at Head of Passes in the Mississippi River Delta, Plaquemines Parish, Louisiana. The area encompasses 1,870 acres of primarily shallow open water bottom and is bounded on the north side by Raphael Pass and to the west by the main river channel.

The proposed site would be in the vicinity of the original Pass a Loutre Sediment Mining project site. This site would allow the cut to take flow from the main river channel just to the north of the mouth of Pass a Loutre. The cut would angle along the mouth of Pass a Loutre cutting through a point bar before breaching the channel bank just downstream of the mouth of the pass.

Problems and Opportunities.

The problems and opportunities which this project addresses are the same as those outlined in the section on generic small scale sediment diversions. This project also has been combined, in concept, with PMR-8, the Pass a Loutre sediment mining project. This allows the reformulated project to capitalize by accruing additional benefits similar to those projected for PMR-8.

Description.

The project will consist of a conveyance channel of approximately 3,500 feet with a bottom width of 430 feet and an invert elevation of -6.0 feet NGVD. This channel should provide an average flow of 2,500 cfs. The construction will consist of hydraulically dredging approximately 550,000 cubic yards of material from Pass a Loutre and the adjacent bank, placing it in an unconfined disposal site. The material will be placed at an elevation no higher than 2.5 feet NGVD and will result in an initial creation of 86 acres of emergent wetlands.

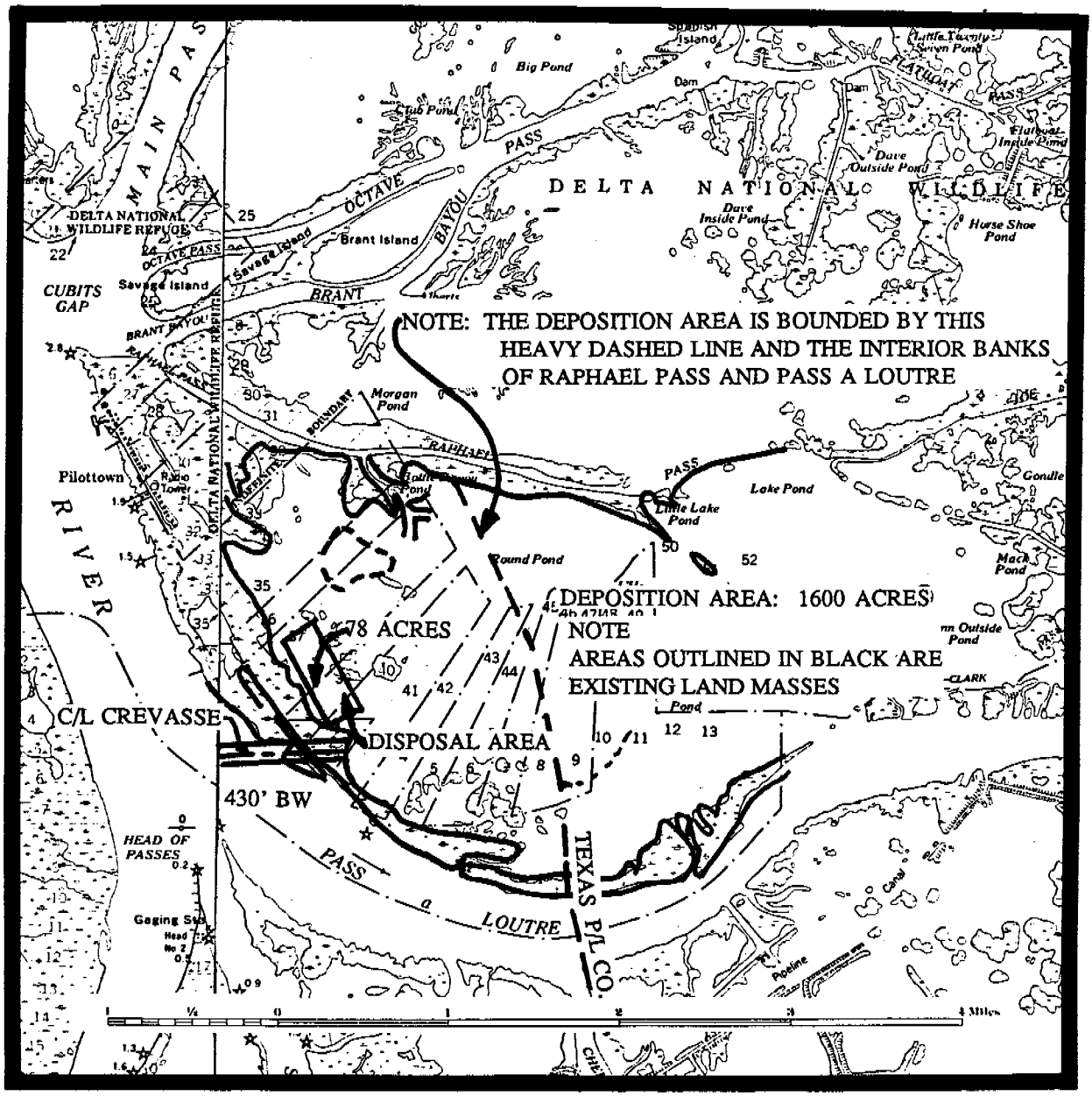
Benefits and Costs.

The project is projected by the WVA analysis to create approximately 900 acres of marsh over its 20-year life. Beneficial placement of the material dredged from the cut for the Pass a Loutre crevasse should create an additional 145 acres of marsh. The Pass a Loutre site will afford protection to some 240 acres of existing marsh. This will result in a net gain of 1,287 acres at the end of the project life.

The total estimated cost for this project is $2,242,000. This estimated cost include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Monitoring costs for this type project have been estimated at $8,625 per year under the CWPPRA monitoring criteria.

Effects and Issues.

This project will provide for the natural capture of available resources. The project Issues for this project would involve the ownership and usage of accreted lands.



Pass a Loutre Crevasse PMR-8/9a

Figure 10

Status.

The Pass a Loutre crevasse project was selected for inclusion on the CWPPRA 3rd Priority Project List. Project costs and benefits have been developed and refined. The project is now undergoing final engineering and design including real estate and relocations investigations.

XMR-10 CHANNEL ARMOUR GAP CREVASSE

Location.

All of the potential project sites investigated are located in Plaquemines Parish, Louisiana. Three existing channel amour gaps on the east bank of the river between Baptiste Collette and Cubits Gap were considered. The selected site is the downstream-most location at approximate river mile 4.9 AHP, six miles south of the city of Venice. This site would serve a 2,100-acre outfall area located predominantly on the Delta National Wildlife Refuge.

Problems and Opportunities.

There are several existing gaps in the stone armoring along the banks of the main river channel which could be utilized as crevasses. The armour gaps on the west bank of the river channel are adjacent to the receiving area of the previously approved West Bay diversion project. Because of this, these sites would not be considered unless the execution of the diversion project was halted. The sites on the east bank of the river channel were considered although they are adjacent to the receiving area of the proposed East Bay large scale diversion. To avoid precluding the construction of the larger project a smaller diversion, which will minimally impact the larger outfall area, will be undertaken.

The basic problems and opportunities which this project addresses are identical to those outlined in the previous descriptions of small scale sediment diversions.

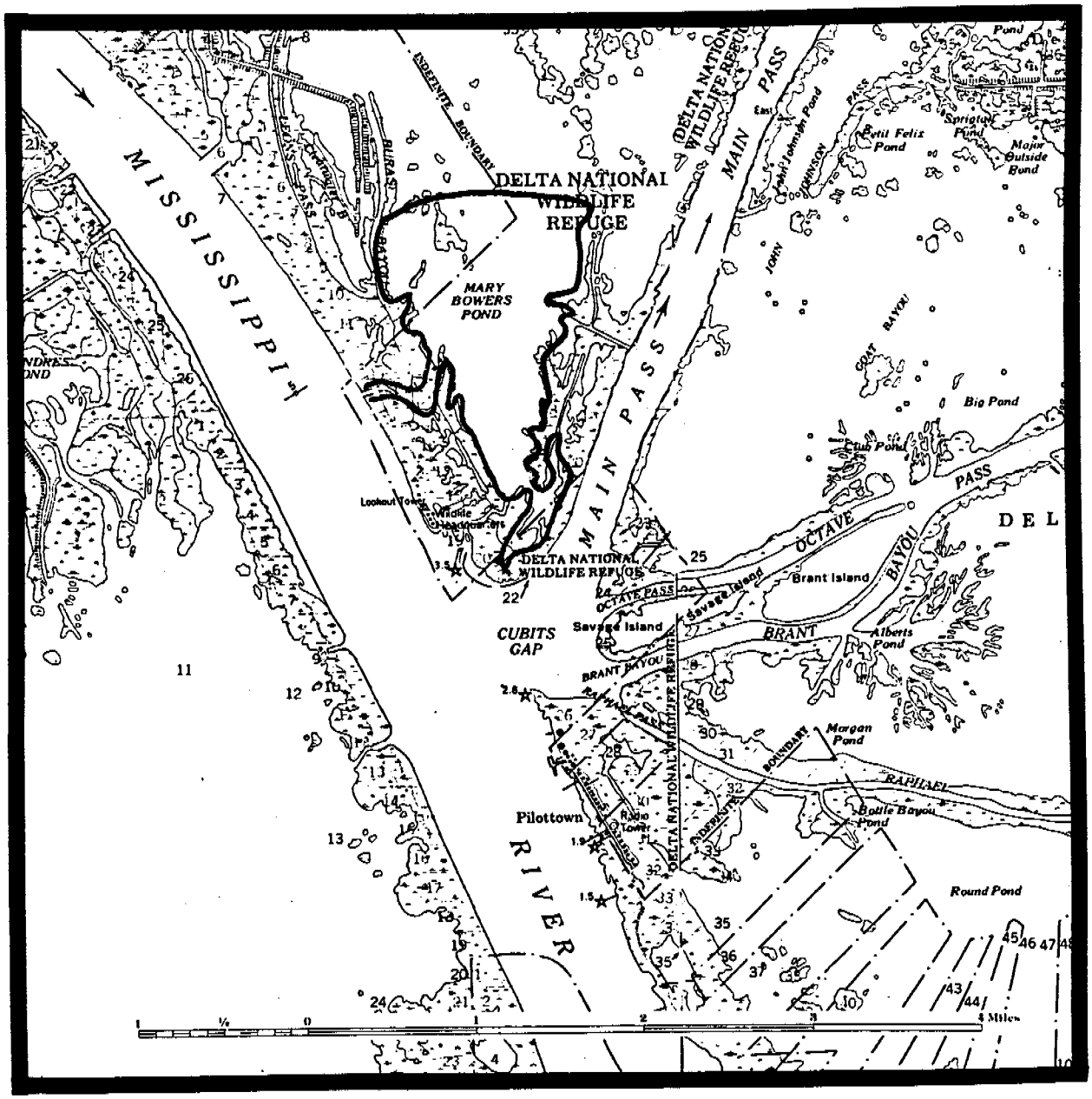
Description

The construction of a crevasse utilizing an existing gap would involve deepening the cross-section and extending an outflow channel into the open water beyond the bank. The project will consist of deepening the invert of an existing 200 foot wide gap in the Mississippi River channel bank armor. The existing invert will be lowered to -4.0 feet NGVD. Presently these gaps have rock armored bottoms at an approximate elevation of 0.0 NGVD. In addition, an existing earthen channel, leading from the armored gap to the open water area beyond the bank, will be enlarged. This channel will have an invert depth of -3.5 feet NGVD and a bottom width of 200 feet. This configuration of channels will allow an average flow of 2500 cubic feet per second to enter the outfall area. The replacement of the bottom armoring would be an available option.

Benefits and Costs.

The WVA analysis of the project projects a net gain of approximately 936 acres of marsh over its 20-year life. This project also will provide protection of an additional 280 acres of existing marsh.

The total estimated cost for this project is $665,000. This estimated cost include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Monitoring costs for this type project have been estimated at $8,625 per year under the CWPPRA monitoring criteria. These projects typically do not have maintenance associated with them.



Channel Armor Gap Crevasse (XMR-10)

Figure 11

Effects and Issues.

This project would introduce flow and sediment into an approximately 2,100 acre area which is 65 percent open water. Over the 20-year life of the project this will result in the creation of roughly 800 acres of emergent wetland and protection of an additional 300 acres of existing marsh. An issue for this particular project may be the effects to navigation from diverting from the main river channel at this location.

Status.

The Channel Amour Gap crevasse project was selected for the CWPPRA 3rd Priority Project List. Project costs and benefits have been developed and refined. This project is pre-designed to a certain extent because the gaps are already in place. The channel reconfiguration is currently being developed along with investigations real estate and relocation needs.

XMR-11 VEGETATIVE PLANTINGS

Location.

Locations for these type projects have not yet been established.

Problems and Opportunities.

A project of this nature, featuring multiple locations, was authorized on the 1st Priority Project List under the CWPPRA. That project included sites in the deltaic plain, the chenier plain and on a barrier island. This project type may be useful in reclaiming areas where vegetation has been lost due to regime changes if the substrate has remained intact.

Description.

These projects consist of plantings of compatible vegetation in areas of high wave energy. Appropriate plant species are planted at uniform interval with a growth enhancing base media added if necessary. This technique is particularly useful in maintaining ridge features which protect areas of marsh.

Benefits and Costs.

The use of these plantings is primarily a protective measure and benefits derived from these projects are based on protecting existing marshes. In some instances benefits may be gained from the specific revegetation of an area but these are generally minimal.

The cost for these plantings, as estimated for the currently authorized projects, is approximately $5.50 per linear foot. Monitoring costs for these types of projects have been estimated at $4,325 per year under the CWPPRA monitoring criteria. Total first costs of any specific project will include 25% contingencies as well as 12.5% Engineering and Design and 11.5% Supervision and Administration costs .

Key Issues.

The authorized project was presented as a demonstration project. Information gained in the execution and operation of this project may effect the possible use of the technique or the locations where it may be applied.

Status.

At this time no vegetative planting projects have been proposed for the Mississippi River Delta basin. Use of this project type in the Mississippi River Delta Basin is only conceptual. However, while a project of this nature is not envisioned in this basin at this time, should an opportunity arise this technique may be readily utilized.

SUPPORTING LONG-TERM PROJECTS

PMR-7 REDISTRIBUTION OF FLOW IN THE MISSISSIPPI RIVER PASSES

Location.

This project would effect the passes of the Mississippi River in its delta south of the latitude of Venice, Louisiana. The most probable candidate locations for the addition of flow would be the northernmost passes of the delta, Tiger and Grand passes on the west bank of the river and Baptiste Collette on the east bank. These passes feed the shallower estuaries adjacent to Barataria and Breton Sound basins respectively. Tiger Pass also flows into an area of extremely high marsh deterioration and would provide supplemental flows to the area of the West Bay Sediment Diversion.

Problems and Opportunities.

A project which fits the long-term goals of this basin would be the redistribution of the flow within the existing passes of the Mississippi River. This would support the greatest optimization of whatever flow and sediment resources are available. Ultimately this project falls into the category of Long-term Supporting Projects because of the need to quantify the design costs and benefits of the project. While many of the technical components necessary for the execution of such a project have been studied, individually and in other project packages, they have yet to be viewed in the proposed context. It should be noted that while this project would certainly aid in the managed retreat of the existing delta, its most serious contemplation would be required if large scale diversion of the river is not undertaken.

Description.

The method of accomplishing this redistribution would involve redirecting flow and sediment from the main river channel into a pass or passes by a mechanical means. The passes which might receive this additional flow would be those which feed the shallowest areas of the birds foot delta. Additionally those passes which feed extensively deteriorated areas of marsh would be candidates for increased flow and sediment. Several methods of executing this redistribution of flows exist. One could be to enlarge the cross-section or increase the invert depth of the receiving channel. Shunting the flow into the receiving channel by means of submerged dikes may be a second option. Another option which could be combined with one of the other methods would be the closure or constriction of some other pass or passes.

Benefits and Costs.

At this time no engineering or environmental investigations have been completed for this project. As a result no specifically quantified costs or benefits are available. Technical reports detailing appropriate structures are available and could be used to aid development of designs and establish gross estimates of construction costs. Monitoring costs would in likelihood exceed the maximum proscribed in the CWPPRA criteria due to the number of physical locations affected in the project area.

Effects and Issues.

The anticipated effect of the added flow and sediment in a given pass would be to increase natural overflows and deposition in the over-bank areas of the pass. There have been no studies initiated to determine what increases in flow would be appropriate or what the resulting benefits in emergent wetlands might be. The possible adverse impacts related to a project such as this would involve sediment deposition, possibly in both the receiving and main river channels. With added flow and sediment in the receiving pass, deposition in that channel could increase. Of course this would be of less concern if a channel enlargement method was employed to capture the additional flow. Induced deposition in the main river channel and the resulting increase in maintenance dredging would certainly be an effect of flow redistribution.

Once again the key issues arising from this project concept, would be those associated with increases in sediment deposition. The effect of this project on the maintenance of navigation and its cost is certainly an issue to be addressed. In addition, both of the preferable passes for this redistribution are federally maintained navigation projects. Although they are not deep-draft channels, induced maintenance dredging in these channels could become an issue.

Another item, which is an issue for all projects which create new emergent wetlands in areas which were previously open water, is the determination of real estate rights. As has been mentioned for several other projects and project types, the final disposition of ownership and the acquisition of real estate rights to satisfy CWPPRA criteria is a major concern. The restriction of surface uses on these created wetlands is essential to providing the required assurance of their long-term conservation.

Status.

The status of this project is purely conceptual. Given the importance of these waterways for navigation access, both in the immediate vicinity and to the entire river system, this project would require detailed study and planning. The nature of the project will also vary as a result of the direction taken for the restoration of this basin.

XMR-13/PBS-7 BOHEMIA SEDIMENT DIVERSION

Location.

The tentative location of the diversion would be in the vicinity of the Bohemia Spillway on the left descending bank of the Mississippi River at approximately river mile 40 AHP. The specific site location could vary up or down stream by roughly five miles. This entire area lies within Plaquemines Parish, within a 5 mile radius of Port Sulphur, Louisiana.

Problems and Opportunities

This project would be pursued as an alternative to the critical project of Diversion of the Mississippi River. Should the critical project be determined to be infeasible this smaller diversion could present a positive response in its place. A Bohemia diversion might also be introduced as an interim step toward the completion of the critical project should its implementation period prove to be excessive. In either scenario this diversion would be on the scale of the approved West Bay and the proposed Benneys Bay sediment diversions.

Description.

The project consists of an earthen broad crested weir and outflow channel. The design is similar to that employed by the West Bay and Benny's Bay projects. This project also has a design flow averaging 50,000 cfs. However, the preferred alternative is a design flow averaging 20,000 cfs. This is due to the difference in configuration of the receiving areas of these projects.

This project, like the West Bay and Benny's Bay projects, would be an uncontrolled diversion. The volume of flow through the diversion is controlled by the channel cross-section and the available hydraulic differential across the cut. This differential is driven primarily by the river stage, however both lunar and wind driven tides can be a controlling factor, particularly during periods of low water in the river. In the vast majority of situations the river stage will be the positive influence on the diversion flow. The project will also include provisions for emergency closure of the diversion cut. This contingency is provided to avoid the possible capture of the river channel or the stoppage of navigation.

Benefits and Costs.

A project of this scale would produce approximately 3,350 acres of marsh and protect and enhance an additional 1,410 acres over a 20-year project life. While this project has not undergone analysis via the WVA format it is based on the design of the West Bay Sediment Diversion project which has undergone this screening.

Total estimated cost for a project of this magnitude is estimated at slightly more than $3.1 million. This cost include 25% contingencies as well as 12.5% engineering and design cost and 11.5% supervision and administration costs. Costs associated with a project of this type and size include operation and maintenance, $35,000 per year, and project monitoring, $55,000 per year which are included in the total. Induced costs would also result from the project. These costs could include impacts to water supplies, increased dredging and emergency closure contingencies.

Effects and Issues.

The character of this area of Breton Sound basin would experience a change from a saline to a freshwater estuary. Along with this change an immediate decrease in water quality would be expected due to the influx of Mississippi River water. However, water quality is expected to improve as new wetlands are created and begin to filter these flows. Although the rapid influx of fresh water into Breton Sound will dramatically change the nature of the sound, elimination of the estuarine system along with spawning and nursery areas for commercial fisheries is not anticipated. It is recognized that estuarine nursery areas will be affected significantly. However, conditions should be enhanced for species which utilize fresh to low salinity marshes as nursery areas, such as gulf menhaden and white shrimp. Species which require more saline nursery habitat will be displaced outward. Some publicly leased oyster grounds would be taken out of production as a result of this project. However, at some point beyond the project life, the area impacted by the project would once again be receptive to these marine communities. Ultimately, the overall extent of available nursery habitat may not change or may actually be increased and or improved as a result of fresh water introduction.

The issues concerning this type project parallel those surrounding the West Bay project. A major issue facing this project involves real estate disposition and the acquisition of real estate rights. In addition separate ownerships or leases of mineral rights on the majority of these tracts may cause concern. A second real estate issue involves the disposition of created wetlands in relation to their long-term conservation. This issue revolves around the limitation of land uses within the project area and the length of time, following construction, that these uses would be restricted. Another issue involving legal and real estate aspects of the project is the disposition of the extensive oyster leases administered by the State of Louisiana in this area.

A serious concern in the area of induced impacts would be the level of increased maintenance dredging and the subsequent effects on the ability to maintain uninterrupted navigation. This concern would be compounded with the assumption that the West Bay Diversion would be completed and operating. Additional design analysis and post construction monitoring may be an issue in the execution of this project as a result. Finally the potential of the diversion capturing the river channel will require the design of a contingency plan and funding for closure of the diversion.

Status.

The status of this project is linked to actions taken in both the Mississippi River Delta and Breton Sound Basins. One or both of these restoration plans could lead to the development and execution of this project. In the meantime diversion projects with higher priority may be executed and demonstrate the feasibility of moderate to large scale sediment diversions. It is believed that the implementation of the West Bay diversion will provide valuable data for incorporation in the design of similar projects and perhaps some insight into the validity of the concerns noted above.

XMR-14 MISSISSIPPI RIVER DELTA DREDGED MATERIAL DISPOSAL PLAN

Location.

The location for projects falling under this plan would all be within the Mississippi River Delta south of Venice, Louisiana in Plaquemines Parish.

Problems and Opportunities.

The hypothetical problem would be the rapid deterioration of freshwater vegetation in the existing delta following diversion of the rivers flow. Following loss of vegetation it is expected that wave energy would begin to rework the remaining tidal flats and channel banks into barrier island forms. This process may involve a significant period of time, however, leaving any remaining wetlands and the developed areas at the extreme southern extent of the existing flood protection exposed to the forces of the open gulf.

By taking advantage of the opportunity presented in the tremendous volume of material dredged each year in the delta this process may be greatly accelerated. In addition, proper design of the overall disposal plan and individual projects could help to enhance retention of available freshwater and suspended sediments. This would in turn promote retention of freshwater vegetation both before and after diversion.

Description.

Individual projects would consist of the placement of primarily coarse dredged material intermittently along a predetermined alignment extending through the entire delta. The material would be placed in shallow open water to an elevation which would approximate the typical dune height of a barrier island. The material would be placed without confinement in order to develop a broad base with gentle slopes. These mounds of dredged material would be placed in sections 500 to 1000 feet in length with broad gaps left between them. Where possible the sections would be abutted to existing channel banks. In addition to the gaps between these sections placement of the material would not be to a uniform height to allow for low spots within each section.

The selective placement of these sections, in conjunction with the existing channel banks throughout the delta, would create a framework to enhance retention of freshwater and sediment overflows.

Benefits and Costs.

Benefits from these projects would be related in directly created acres of coastal barrier habitat and attendant "back bay" marsh habitat. An additional benefit might be the protection of existing fresh marsh and potential to trap fine sediments. Development of specific project benefits will be subsequent to development of the overall disposal plan.

Because the projects inclusive to this plan are not set in design their costs may only be grossly estimated. The basic cost for any dredging contract involves mobilization and demobilization cost for equipment to be used. This cost may be significant depending on the size of the job and the timing of the start of construction. The largest portion of the construction cost for a dredging project hinges on the total volume of material to be moved and the unit price for the excavation and placement of that material. Unit costs vary with the distance from

the source to the placement sites. The unit costs will vary between maintenance and dedicated dredging projects because additional pumping distance is usually required for the beneficial placement of maintenance material.

Effects and Issues.

The issue which may well arise in conjunction with these projects is the conversion of open water to barrier type ridges in areas of predominantly fresh marsh. This may raise particular concern since these actions would necessarily proceed the actual diversion of the river. In light of this fact the timing of construction may be a critical element for these projects.

Status.

At this time the status of individual projects or a comprehensive plan involving the placement of dredged material in the existing delta is entirely conceptual. The future of either of these initiatives will be tied to the development and completion of the feasibility study for a major diversion of the Mississippi River.

PROJECTS NOT INCLUDED IN PLAN

PMR-1 RIVERSIDE BAY WETLAND CREATION.

Location.

The project location is in Plaquemines Parish , Louisiana, 11 miles south of the city of Venice. The project is currently located immediately east of the Head of Passes of the Mississippi River in the Riverside Bay area. A new project location is needed since the initially proposed location overlaps the project area of the approved West Bay Sediment Diversion.

Problems and Opportunities.

This project seeks to beneficially use sediments dredged from the near by Mississippi River navigation channel. The project further seeks to armor the newly created wetlands with a readily available commodity, used auto tires.

Description.

The project consists of a pair of bulkhead enclosures, constructed from used tires and enclosing 50 acres of shallow open water area. The bulkhead structure would be anchored to piles spaced at approximate 10 foot intervals. The tires would be connected by specially anchored bolts both to one another and to sleeves fitted over the anchor piles. Once constructed, the enclosures would be filled with approximately 125,000 cubic yards of pumped dredged material to an elevation consistent with ambient marsh in the area.

The total first cost is estimated at $1,550,000 including 25% contingencies as well as 12.5% Engineering and Design cost and 11.5% Supervision and Administration costs. No maintenance is prescribed for this project and $100,000 is scheduled for project monitoring over its 20-year life. This exceeds the minimum proscribed monitoring budget for this type project. The initial acreage created would be 100 acres, however it is estimated that all but 9.2 acres would be lost by year 20 of the project life.

Effects and Issues.

This project was proposed as an opportunity to beneficially utilize material dredged by hydraulic dredge from Southwest Pass to create 100 acres of marsh in shallow open water. However all material dredged in that manner in the Mississippi River delta currently is being put to beneficial use.

An issue raised in the initial screening of this project was the durability of the used tire bulkhead structure in an open water environment. Failure of this structure could produce an adverse impact to the project area. A second concern is the estimated loss of over 90 percent of the initially created acreage due to subsidence and overwash, despite confinement within a bulkhead. Finally a new project location must be determined in order not to overlap benefits with other approved projects. Further investigation will be required if this technique is to be utilized in a project.

Status.

This project, in its current form, has undergone a preliminary screening for Priority Project List consideration and a Fact Sheet has been developed. After this

initial review the project was eliminated from consideration due to the concerns outlined above. While the project concept may have merit, the issues raised must be resolved prior to its consideration as a viable tool for wetland restoration.

XMR-12 BENEFICIAL USE OF HOPPER DREDGE MATERIAL.

An area of useful research and development for this basin, as well as the Mississippi River itself or any basin with deep-draft navigation, is the beneficial use of material dredged by hopper dredge. A large volume of sediment is removed from the Mississippi River and Southwest Pass by hopper dredging. Development of an efficient means of utilizing this material would greatly increase the sediment resource available for coastal restoration in this basin. This concept is of particular interest in this basin because most major proposed projects involving the use of Mississippi River discharges, including the critical project for the basin, result in some level of increased deposition in the navigation channel. This in turn results in increased cost and effort in order to maintain navigation in this deep-draft channel.

A possibility that bears some investigation is that collection and delivery of sediments to a channel-side location by hopper dredge could be as cost effective, by unit cost, as any method available. It is recognized that the combining of normal maintenance dredging and disposal for marsh creation is not presently an efficient marriage of purposes. Research in this area may identify a means of combining these two functions compatibly or an efficient method for dedicated dredging, for marsh creation, using hopper dredges.

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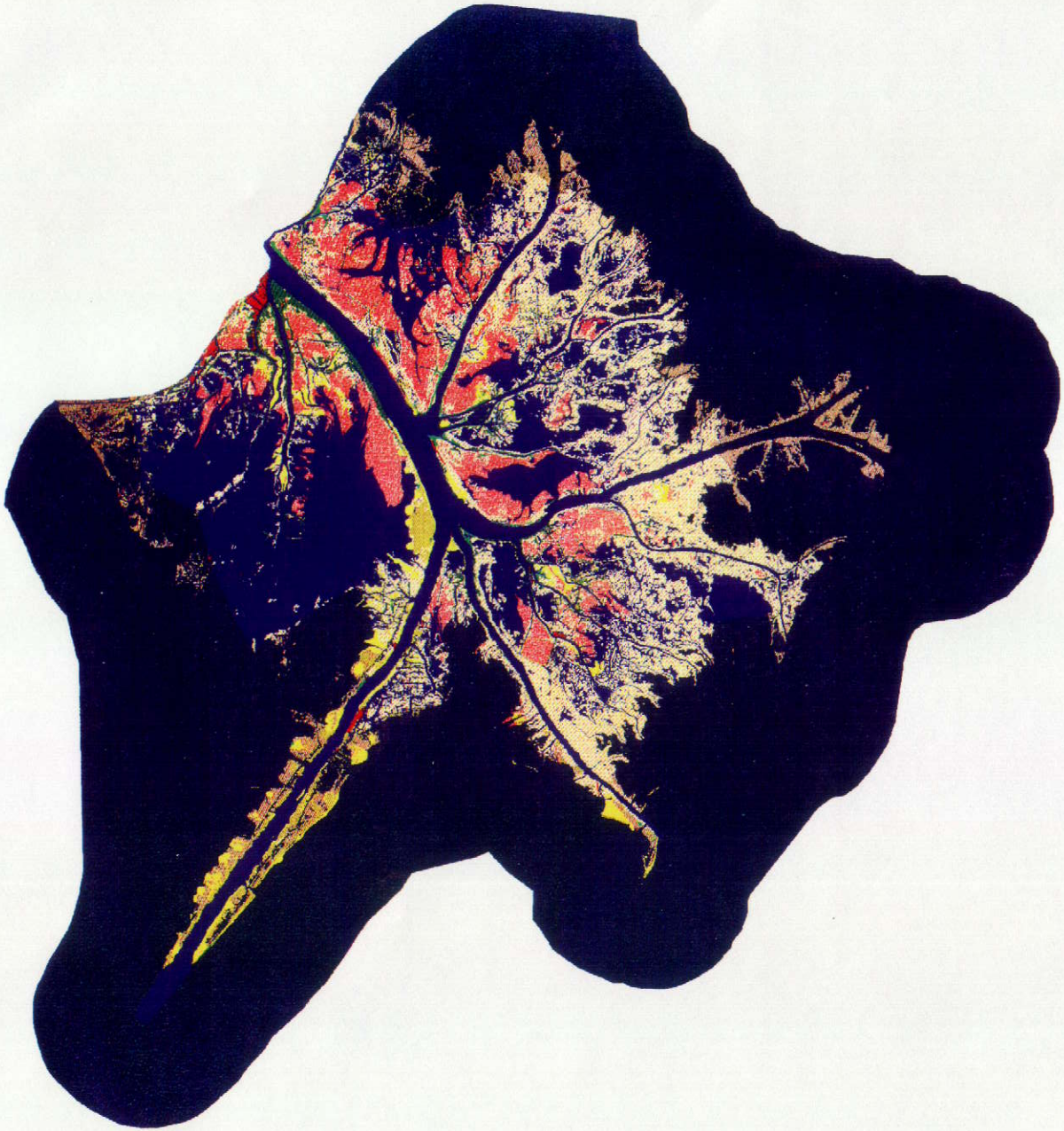
Plate 1, 1988 Habitat Data



Legend

1 AB Floating
2 AB Submerged
3 Fresh Water
4 Estuarine Water
5 Fresh Marsh
6 Intermediate Marsh
7 Brackish Marsh
8 Saline Marsh
9 Estuarine Marsh
10 Cypress Forest
11 Bottomland Forest
12 Dead Forest
13 Bottomland SS
14 Shore/Flat
15 Ag/Pasture
16 Upland Barren
17 Upland Forest
18 Developed
19 Upland SS

Louisiana Coastal Wetlands
Restoration Plan
Mississippi River Basin

1988 HABITAT DATA

date: April 1993

PLATE 1